VOLUME XXXVI • No. 189 • NOVEMBER-DECEMBER, 1951

ORDNANCE

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HARRY L. ERLICHER
Special Assistant to Under Secretary of the Army

IN THIS ISSUE...

KENT-MOORE . . .

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ORDNANCE

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The Magazine of Scientific and Industrial Preparedness

Vol. XXXVI NOVEMBER-DECEMBER, 1951 No. 189

FEATURES

Harry L. Erlicher . . . . . **Front cover**
Exclusive photograph for ORDNANCE *by Harris & Ewing*

Pointed Reminder . . . . . **Frontispiece**

Efficiency in Defense Production 393
Harry L. Erlicher adds the business viewpoint

Novel French Aircraft . . . . . **William Green** 394
Radical designs may forecast future trends

We Need Engineers . . . . . **Dr. S. C. Hollister** 398
A strategic resource is in very short supply

Wright Air Development Center . . . **Capt. H. S. Fisher, Jr.** 401
Powerhouse of our technological air superiority

Improving Ordnance Management . . . . **Col. E. C. Bomar** 403
New program stimulates better business methods

Aircraft Armament—A Power for Peace 406
A pictorial account of the Thirty-Third Annual Meeting, A.O.A.

Automatic Small Arms . . . . . **Melvin M. Johnson, Jr.** 412
"The Machine Gun" is encyclopedic in data and detail

Month by Month 416
High lights of the national defense

Security with Economy 419
An editorial on the rising cost of national defense

Industrial Mobilization Dinner Meeting 420
Announcement of the Association's annual gathering in New York

DEPARTMENTS

Atomic Energy 386
Association Affairs . . . 421
New Developments . . . 425
From the Record 436
Book Reviews 440
Index of Advertisements . . 483

ARMAMENT TECHNOLOGY

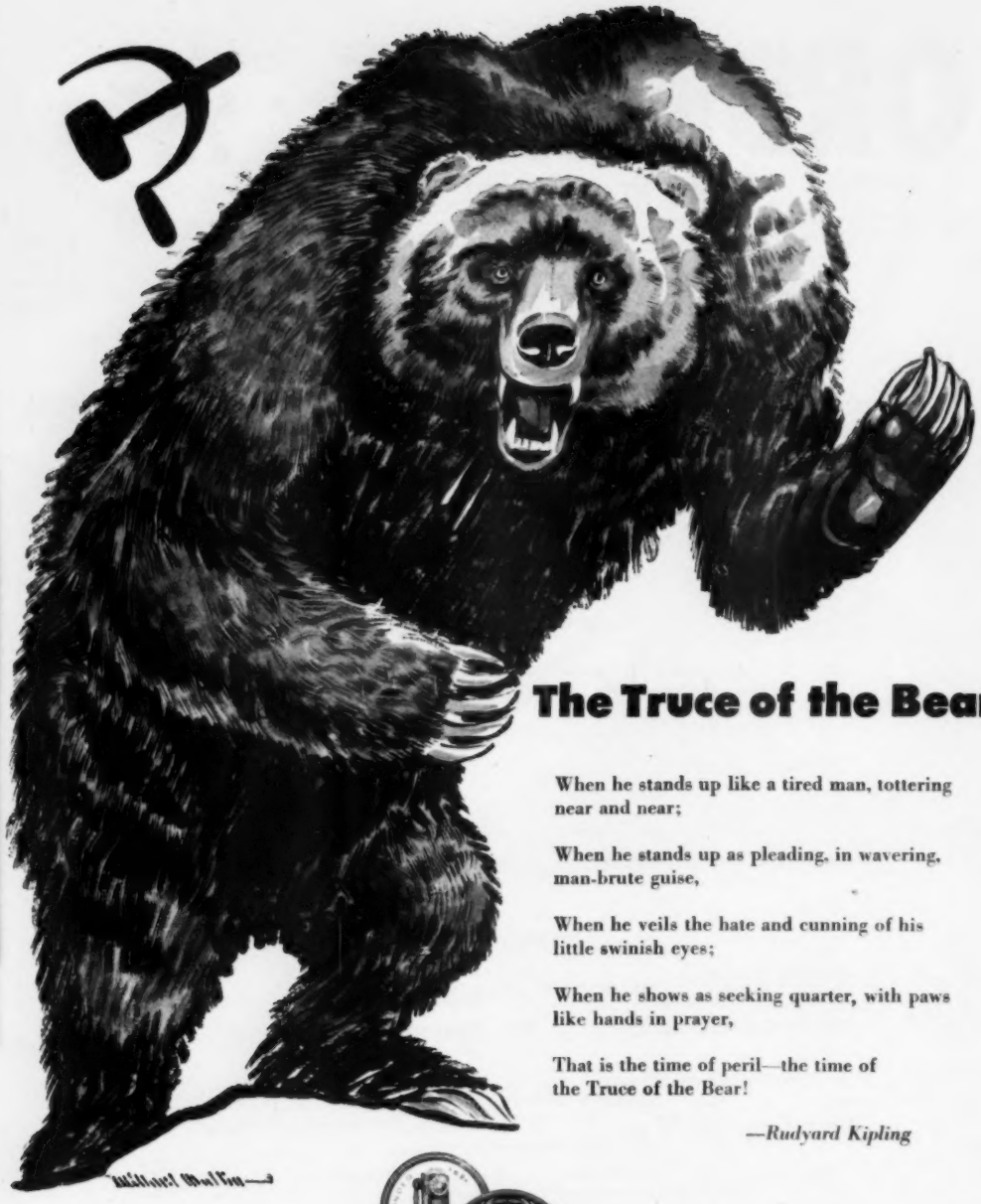
New Trucks for Old . . . . . **Brig. Gen. Gerson K. Heiss** 485
Ordnance assembly line rebuilds vehicles in Japan

Ordnance Gage Procurement . . **Lieut. Col. Winthrop P. Hersey** 490
A vitally important function of the district offices

Confederate Handguns . . . . . **William A. Albaugh, III** 493
A collector's detailed study of Southern pistols

Logistical Commands . . . . **Lieut. Col. John W. Schroder** 502
A profitable field for manpower economies

ORDNANCE is published bimonthly by the American Ordnance Association, 703 Mills Building, Washington 6, D. C. Entered as second-class matter, August 14, 1920, at the Post Office at Washington, D. C., under the Act of March 3, 1879. Additional second-class entry at the Post Office at Richmond, Va. Subscription rate: Continental U. S. and possessions, $4.50 annually, in advance; foreign, $6.00. Copyright 1951 by the American Ordnance Association. Title registered United States Patent Office. SIX weeks' notice before next publication date required for change of address. ORDNANCE is combined with FIREPOWER and LOGISTICS, formerly published by the American Ordnance Association. *Editor:* Leo A. Codd. *Managing Editor:* R. E. Lewis. *Editorial Staff:* M. L. Van Horn, J. J. O'Connor, F. W. Foster Gleason, R. K. Smith. *Staff Assistants:* C. C. Alexander, G. C. Anderson, L. E. Bowman, P. Cooke, G. M. Crump, F. G. Ferriter, M. E. Ferriter, K. C. Hankey, F. A. Owens, B. M. Rounds, M. J. Webb, N. A. Woodhouse. *Advertising representative:* Thomas O. Woolf & Son, 70 E. Forty-fifth Street, New York 17, N. Y. Advertising rates and publication schedule sent on request.



The Truce of the Bear

When he stands up like a tired man, tottering near and near;

When he stands up as pleading, in wavering, man-brute guise,

When he veils the hate and cunning of his little swinish eyes;

When he shows as seeking quarter, with paws like hands in prayer,

That is the time of peril—the time of the Truce of the Bear!

—*Rudyard Kipling*

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AUDOGRAPH

Walter E. Dituars

President, The Gray Manufacturing Company
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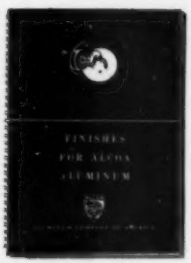

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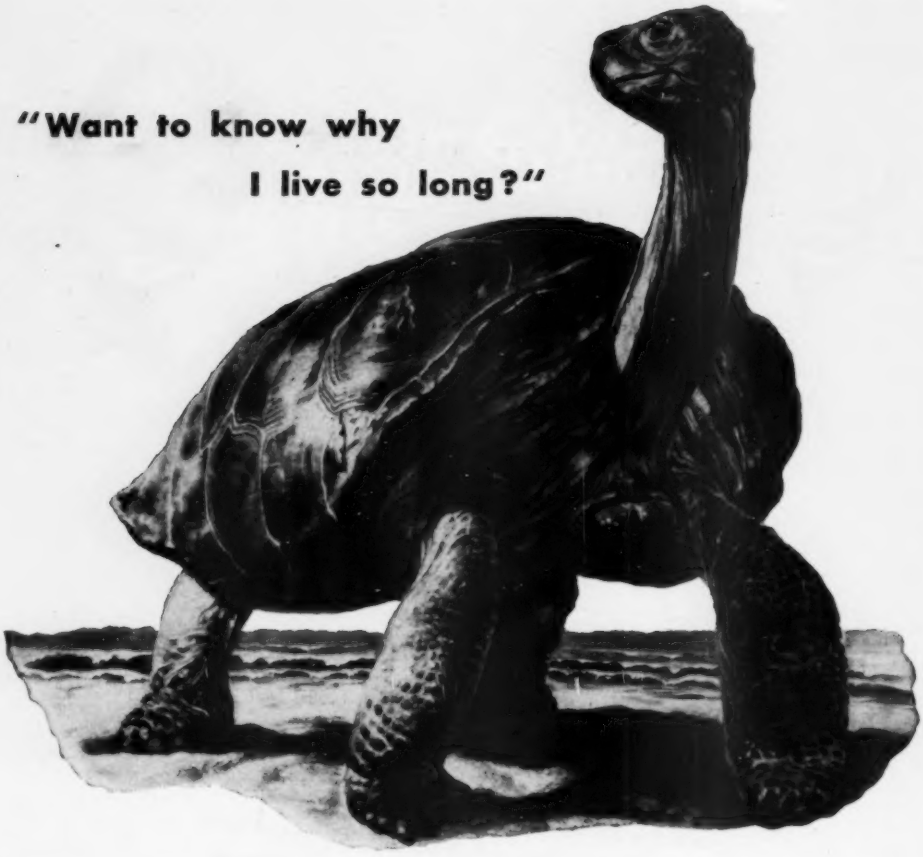

PROTECTION—that's the answer. Old Galapagos' horny shell forms an effective barrier against any and all attackers, and he lives on and on!

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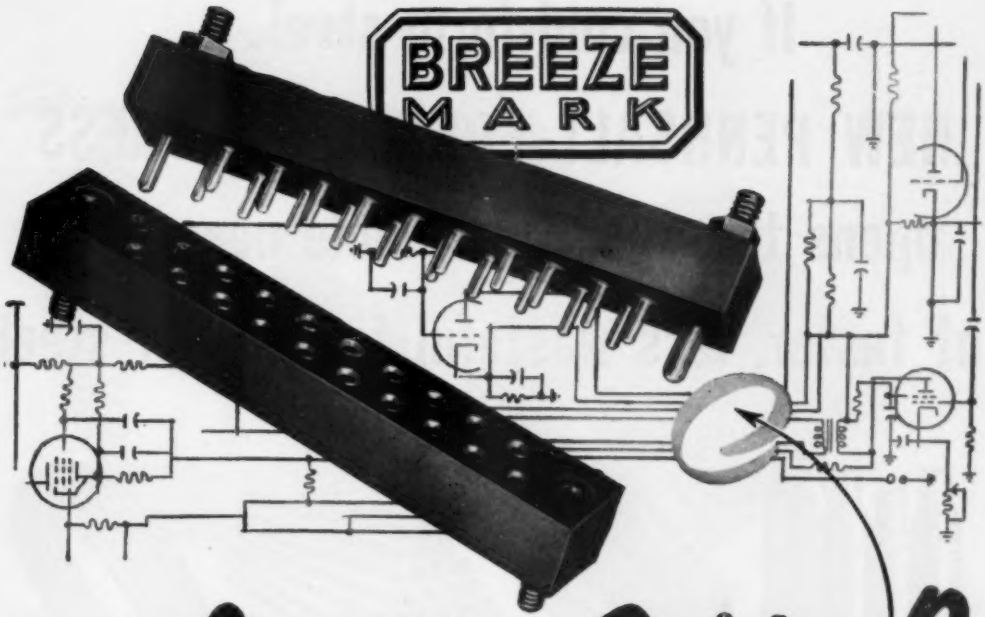

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...We'll take it from HERE

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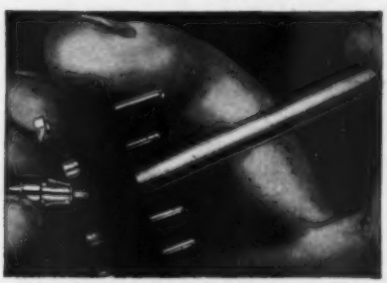
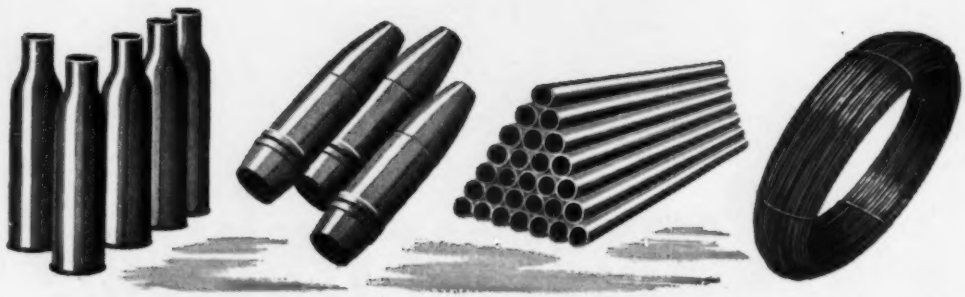


Removable pins in Breeze connectors speed soldering, save time, trouble. Pins snap back into block.

If you cold-form steel...

NEW PENNSALT FOSCOAT® PROCESS opens the door to a whole new world of faster, less wasteful forming of steel



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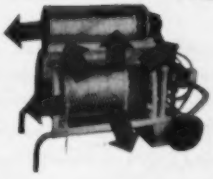

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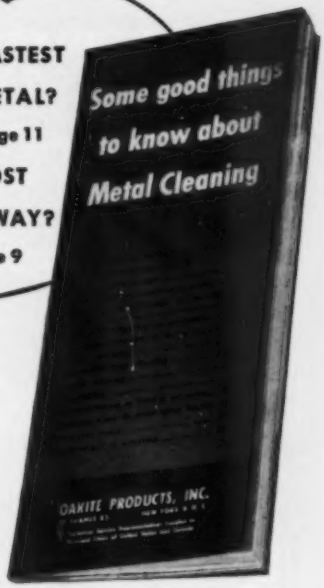
See page 11
WHAT'S THE MOST ECONOMICAL WAY?
See page 9



answers many questions that mean better production, more profit for you. Just look at the table of contents:

- Tank cleaning methods
- Machine cleaning methods
- Electrocleaning steel
- Electrocleaning nonferrous metals
- Pickling, deoxidizing, bright dipping
- Pre-paint treatment in machines
- Pre-paint treatment in tanks and by hand
- Paint stripping
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You'll want to know the answers

Can one cleaning material do all metal-cleaning jobs? *See page 5.*

What kind of cleaner attracts both oil and water? How does this help remove buffing compound residues and pigmented drawing compounds? *See page 8.*

Why clean ferrous and nonferrous metals in separate tanks? *See page 10.*

What are the advantages of reverse current for electrocleaning steel? *See page 15.*

For electrocleaning nonferrous metals, what are relative advantages of cathodic, cathodic-anodic and soak-anodic cleaning? *See page 17.*

Can you electroclean brass without tarnishing? *See page 18.*

How do bright dips make metals brighter? *See page 21.*

Can you clean steel and condition it for painting for less than 20 cents per 1,000 square feet? *See page 26.*

Would you like a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page 28.*

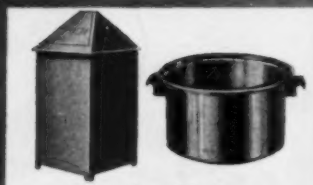
What's the best way to clean parts that are too large to be soaked in tanks or conveyed through washing machines? *See page 30.*

Does your burnishing barrel produce a luster you are proud of? *See page 32.*

What do you do when the overspray neither sinks nor floats in the wash water in your paint spray booth? *See page 35.*

Do you dry steel parts before anti-rusting? *See page 37.*

Heavy Duty Trailers



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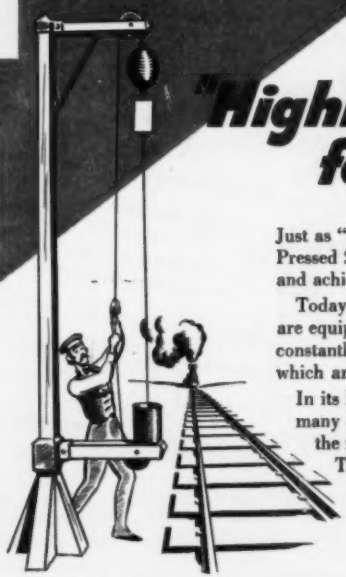

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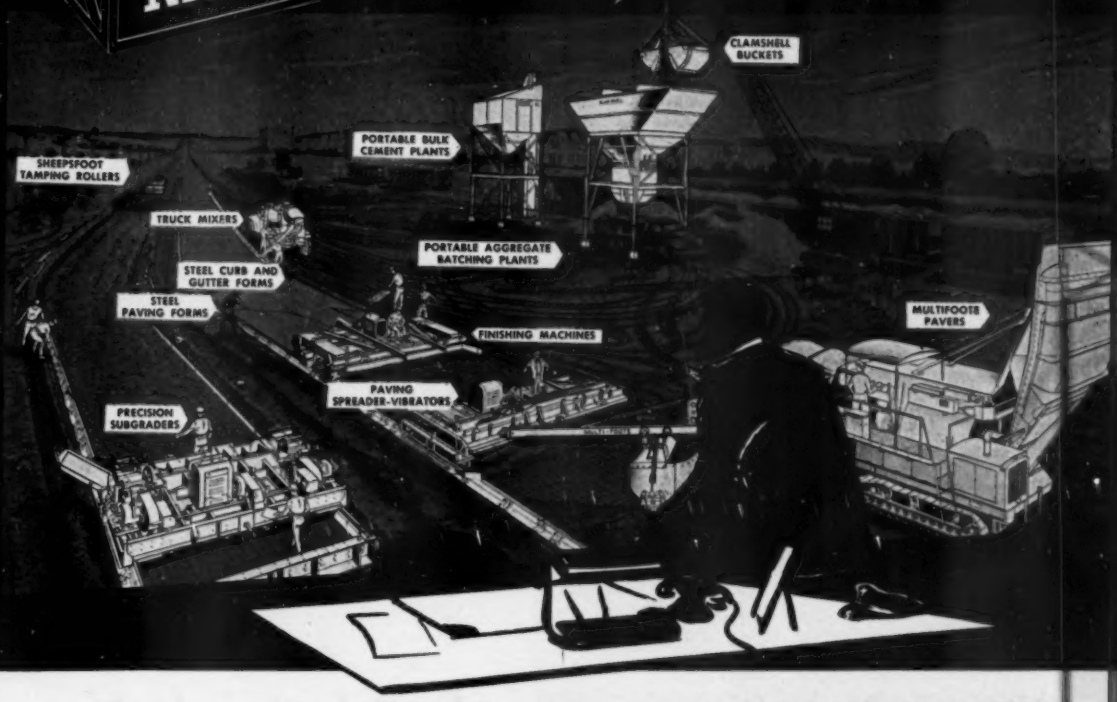

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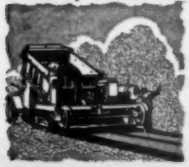

WHEN the need is for speed in building roads and airports, do you know the advantages of mechanizing your paving jobs with one "Complete Package" of equipment from one responsible source?

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- The "Complete Package" gives you 100% mechanization, with every step dovetailed and balanced for the assembly-line production that steps up the pace of the job.
- In addition, you get these *one-source* advantages . . . you get all your equipment on *one* order, in *one* shipment, backed by *one* responsible manufacturer. You have *one* source for prompt service on replacement parts. Paper work is held to the minimum!

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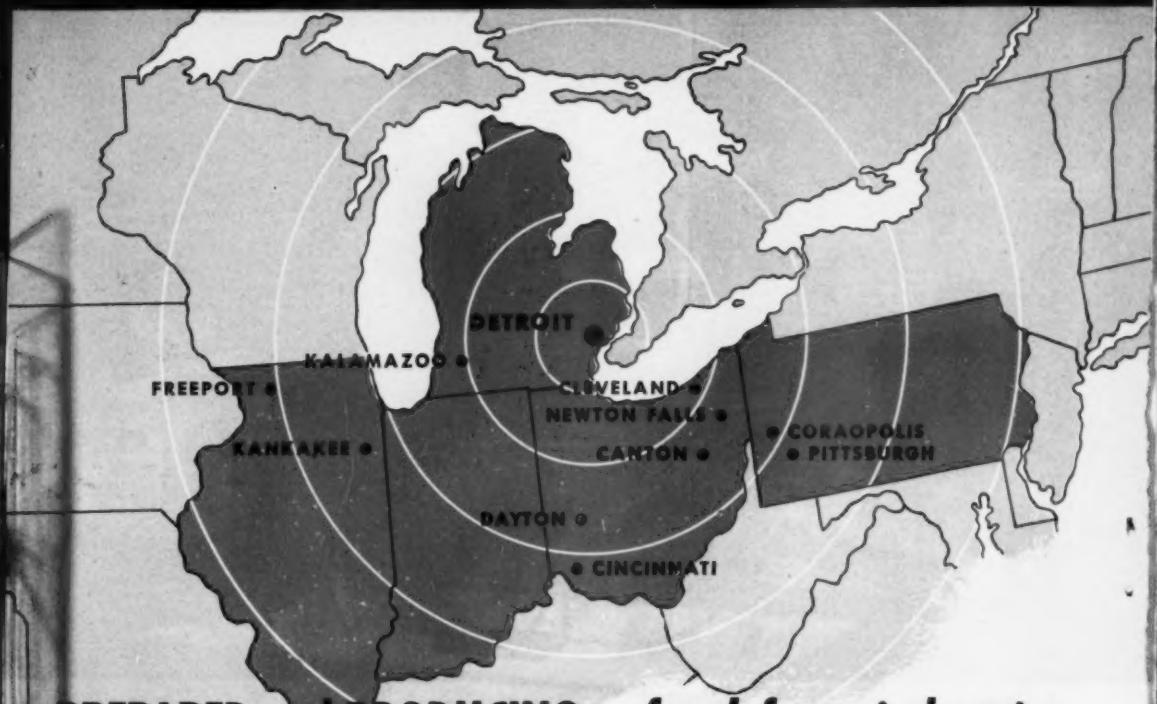

PREPARED and PRODUCING ... *for defense industries*

A glance at the map shows the studied manner in which Standard Steel Spring Company has located the facilities associated with its huge armor plate program. To save in distribution, plants are spotted within the area where a high percentage of defense contracts center.

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Ready to Assemble

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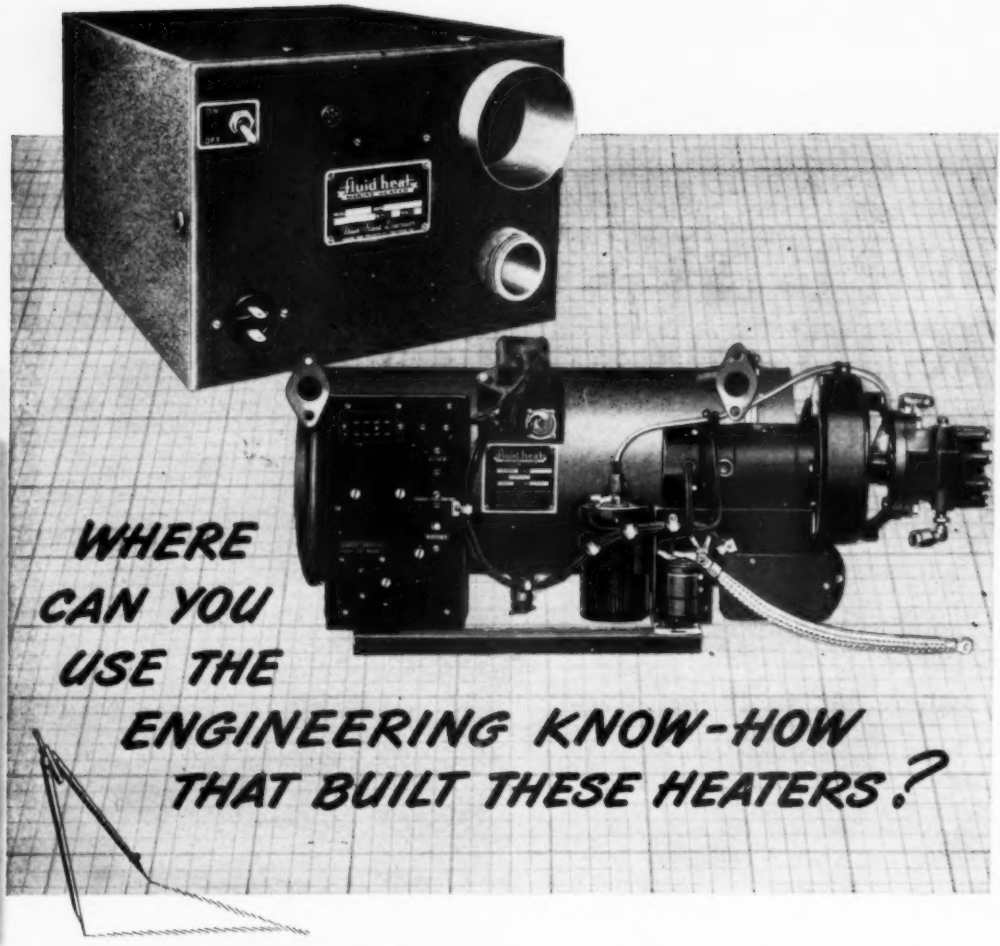
ARMOR PLATE DIVISION — PENOBSCOT BLDG. — DETROIT, MICHIGAN

for Ordnance



FLUID HEAT ENGINEERING KNOW-HOW has produced compact, independently operated space heaters for trucks, boats and tanks that faithfully put forth from 15,000 to 100,000 BTU per hour on a minimum of gasoline, kerosene, or fuel oil.

From the same boards have come the famous Fluid Heat automatic engine preheaters that give instant starts even though vehicles or boats are faced with Arctic temperatures.

You can put this vast engineering experience to work for you. What type of heating unit do you need? Will one of Fluid Heat's standard units, or an adaptation of one, do the job? Or do your requirements demand the design and development of more specialized equipment? In either case, Anchor's experience is at your command . . . as close as your phone or your secretary's typewriter.

Write or phone the Fluid Heat Division, Engineering and Design Section, and outline your problem. Specifications, data, and above all, *experience*, are yours for the asking!

fluid heat
PRODUCTS

DIVISION OF ANCHOR POST PRODUCTS, INC.
6805 Eastern Ave., Baltimore 24, Md.
Phone BRoadway 1500

DESIGNERS AND MANUFACTURERS OF Space Heating Equipment • Fluid Heat Marine Heaters • Cargo Heaters • Coolant Preheaters • Automatic Oil Heaters • Rotary Burners • Boiler Burner Units • Air Conditioning Heaters • Pressure Burners

PRESSING . . .

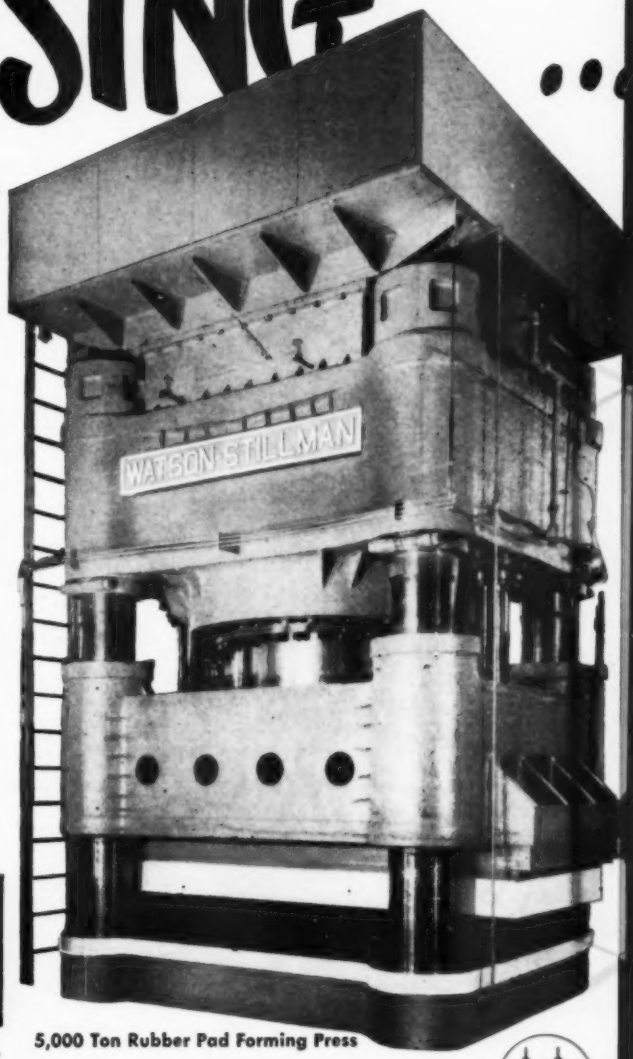
out the ARMS for UNCLE SAM!

Planes . . . tanks . . . guns . . . shells . . . shell cases or any one of a thousand and one other items that must be produced, as long as it can be pressed out of metal, there's a W-S Press to do the job . . . and more economically, too.

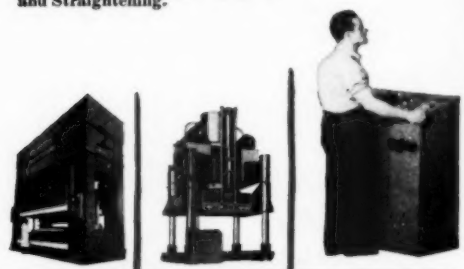
W-S Medium and Deep Draw Presses do things faster. Rejects are virtually eliminated . . . present dies and materials can be used . . . one or more draws may be cut from a progressive operation, thereby saving man hours on the job . . . intermediate annealing is often reduced or eliminated and total production time cut down.

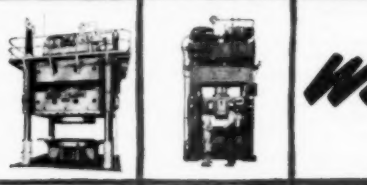
Designed for precision work and built for long service, these W-S Hydraulic Presses offer further advantages in set-up, maintenance and tool life. Available in a large choice of pumping units and controls. It will pay you to investigate their flexibility.

Other W-S Metal Working Presses include those for Forming, Flanging, Trimming, Forging, Coining, Hobbing, Extruding, Briquetting, Bending and Straightening.



5,000 Ton Rubber Pad Forming Press





HYDRAULIC MACHINERY DIVISION

WATSON-STILLMAN Established 1848

Factory and Main Office: 164 Aldene Rd., Roselle, New Jersey

Branch Office: 228 No. La Salle St., Chicago, Illinois

REPRESENTATIVES

Birmingham 3, Ala. . . . . George M. Meriwether
Dallas, Tex. . . . . M & R Sales Co.
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Indianapolis 20, Ind. . . W. K. Millholland Mach. Co.
Los Angeles 11, Cal. . . . . H. M. Royal, Inc.
Pittsburgh 19, Pa. . . . . Stanley Berg & Co.
Portland, Ore. . . . . Machinery & Tool Supply Co.
Rochester 12, N. Y. . . . . Watson-Stillman Co.
San Francisco 7, Cal. . . Schellenbach Mach. Tool Co.
Seattle, Wash. . . . Machinery & Tool Supply Co.
Spokane 8, Wash. . . Machinery & Tool Supply Co.
St. Paul 4, Minn. . . . Anderson Machine Tool Co.

Manufactured in Canada by—CANADIAN VICKERS, Ltd., Montreal

W-S "COMPLETELINE" HYDRAULICS . . . THE SHORTEST DISTANCE FROM PRODUCTION TO PROFITS

Take a GOOD LOOK at this BIG PLANT Defense effort

It depends upon SMALL PLANTS FOR ITS SUCCESS!

With 6 big plants across the nation producing Trailers for civilian and military needs, Fruehauf draws upon suppliers of basic materials and component parts in 38 states.

Two thousand seven hundred and forty-five of these sub-contractors help feed the Fruehauf assembly lines — share in the defense contracts Fruehauf receives. All are a part of the united effort to provide greater production, *quickly*, to fill the nation's need for Trailers.

A united defense effort is a common cause, *shared* by all with benefits to everyone! So, while these 6 big plants turn out Trailers, thousands of smaller plants turn out the products which keep them running at an ever increasing pace — a tribute to teamwork!

FRUEHAUF TRAILER COMPANY • DETROIT 32, MICHIGAN

EVERYBODY *Shares in a* UNITED *Defense Effort*

Every Trailer on the Road Contributes to NATIONAL DEFENSE

Whether the load is Tank parts or tomatoes, every Trailer is contributing to National Defense . . . supplying industry, feeding men and delivering finished products.

Distribute the Load — Protect the Road

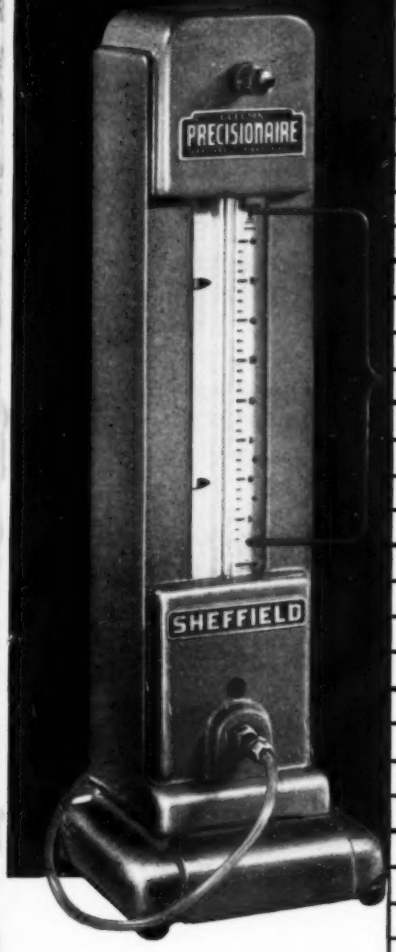
A smooth wheeling Truck-Trailer helps protect our roads. Their many large pneumatic tires distribute load weight over a great area of the surface—cushion impact before it reaches the pavement.

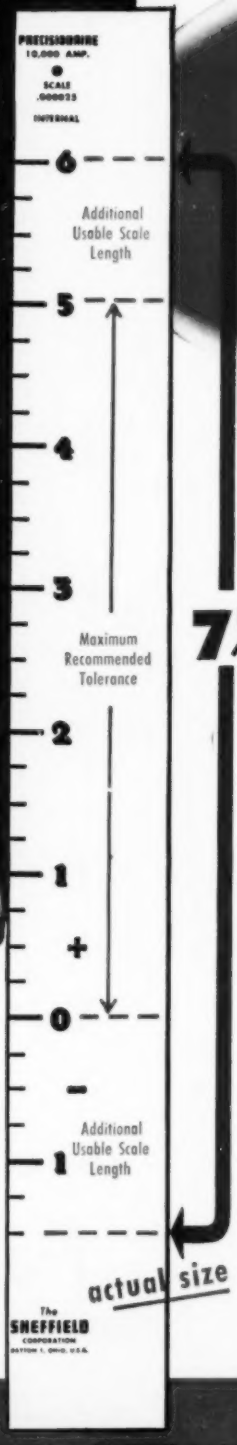
FRUEHAUF *Trailers* "ENGINEERED TRANSPORTATION"

Twice as much Usable Scale Length

with a

SHEFFIELD COLUMN PRECISIONAIRE





MODEL NUMBER	MAXIMUM RECOMMENDED TOLERANCE	MINIMUM USABLE SCALE LENGTH BEYOND TOLERANCE LIMITS
1,000	.005	.0025
2,000	.0025	.0013
5,000	.001	.0005
10,000	.0005	.00025
20,000	.00025	.000125

7½ inches of usable scale length—more than twice as much as most other air gages.

MANY MORE CLASSIFICATIONS—more selections can be made because of the extra scale length—manufacturing tolerances can be widened to save time and cost without sacrificing quality.

SHOWS *HOW MUCH* PARTS ARE OUT—especially advantageous where parts are coming consistently on the borderline or just outside tolerance limits.

BETTER FOR BRINGING TO SIZE—Readings can be taken earlier when approaching size so that the operator is sure of not going beyond tolerance, in fact, he can accurately work to desired limits *within* the tolerance zone.

CLOSER MACHINE CONTROL—with greater scale length the trend of the machine and tooling to go out of control *shows up sooner*, reducing possibility of rejects.

MORE ACCURATE QUALITY CONTROL CHARTS—the column Precisionaire scale is a running quality control chart in itself. Readings can be transferred to a chart with greatest accuracy.

OPERATORS LIKE THE LONG SCALE—with higher amplifications the spread for the tolerance and each classification is wider, making the operator's job easier.

PHONE, WIRE, OR WRITE CUSTOMER CONSULTATION FOR DEMONSTRATION IN YOUR PLANT. CATALOGS CAN BE SENT AT ONCE.

the *Sheffield* corporation
DAYTON 1, OHIO, U.S.A.

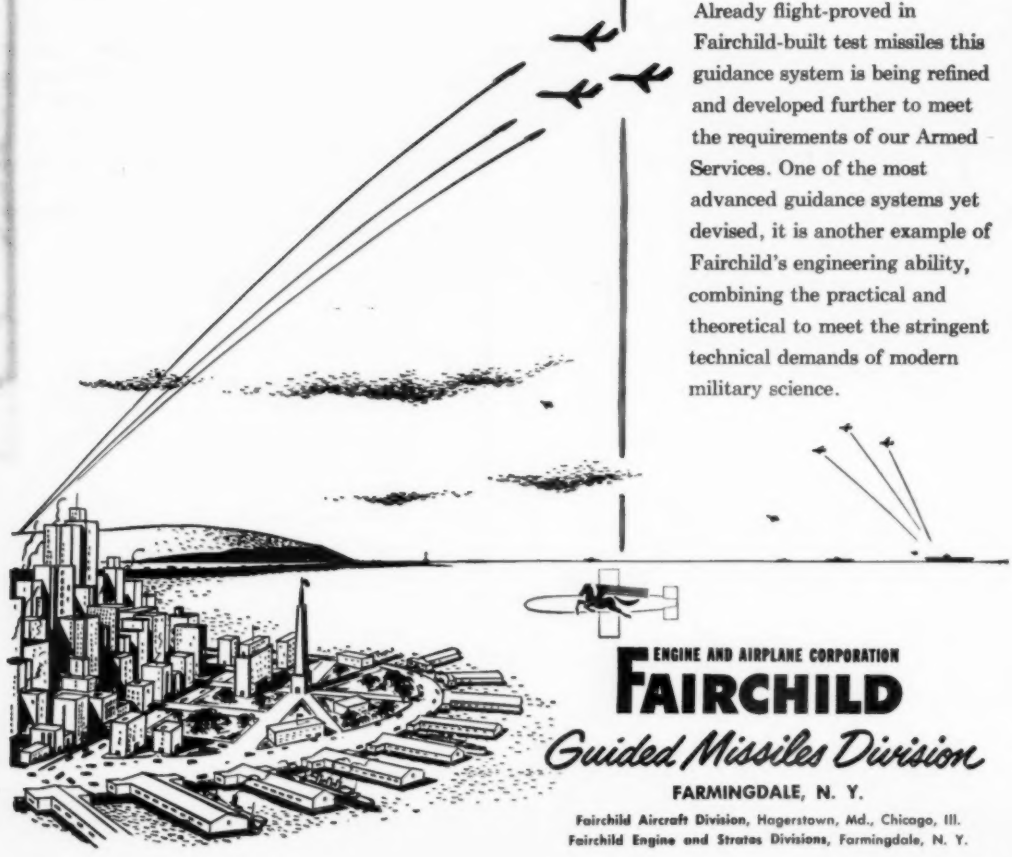
GAGES • MEASURING INSTRUMENTS • MACHINE TOOLS • CONTRACT SERVICES • THREADING TOOLS

BRAIN WORK

high in the heavens

GUIDED MISSILES that become more accurate as they close the range on attacking enemy aircraft are being developed by the Fairchild Guided Missiles Division. Missile experience dating back into World War II has enabled Fairchild engineers to design a guidance system which "homes" on radar echoes reflected from attacking planes and cuts down the margin of error the closer the "bird" gets to its target.

Already flight-proved in Fairchild-built test missiles this guidance system is being refined and developed further to meet the requirements of our Armed Services. One of the most advanced guidance systems yet devised, it is another example of Fairchild's engineering ability, combining the practical and theoretical to meet the stringent technical demands of modern military science.



ENGINE AND AIRPLANE CORPORATION

FAIRCHILD

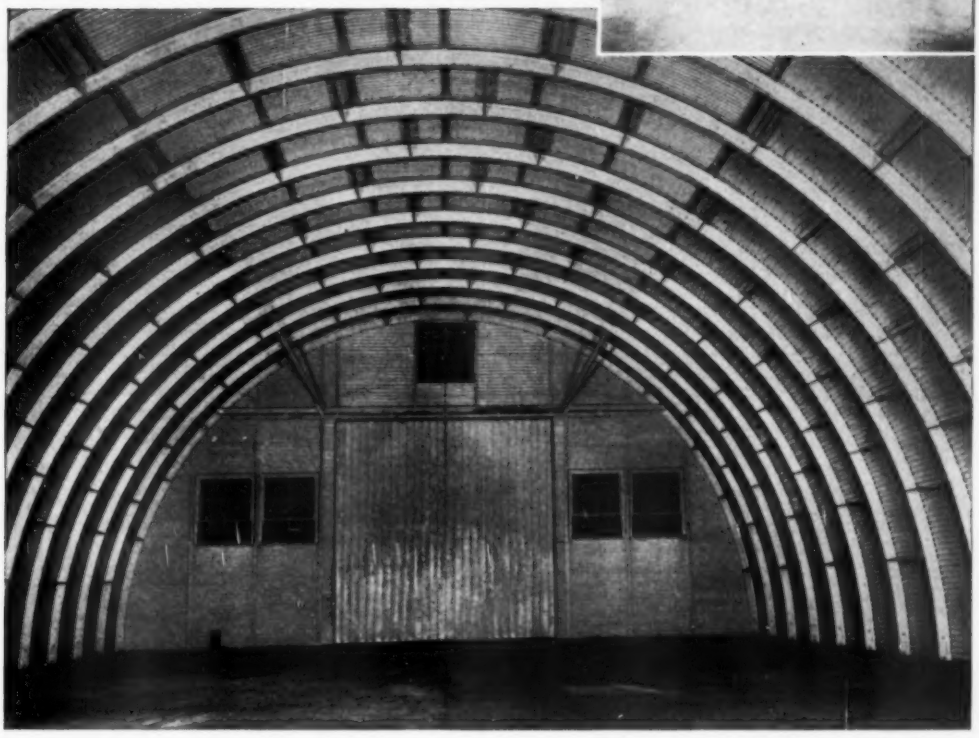
Guided Missiles Division

FARMINGDALE, N. Y.

Fairchild Aircraft Division, Hagerstown, Md., Chicago, Ill.
Fairchild Engine and Stratos Divisions, Farmingdale, N. Y.

FOR MILITARY USE...

ALL-STEEL QUONSET BUILDINGS



Today's improved and strengthened clear-span Quonsets offer every advantage for military use: Light weight to save on rail freight • Smallest cube to save on ocean freight • Quick, easy erection, without crane or trained personnel • Proved adaptability to extreme hot or cold climates by use of carefully designed arctic or tropical adaptation kits • Your best all-around value for military use in terms of lowest cost per square foot, cubic foot, per man housed or per pallet stored.

QUONSET 40 x 100 *is ideal for many kinds of storage —supplies, ammunition, ordnance equipment, vehicles, repair shops, etc. Nailable ribs and studs permit easy application of insulation and lining for personnel. (Insert shows a recreation hall.)*

QUONSET 20 x 48 *is designed to serve many military housing needs, such as barracks, offices, classrooms, or shops. Successfully used in every part of the world.*

Write to us today for full information.

STRAN-STEEL FRAMING

GREAT LAKES STEEL CORPORATION

Stran-Steel Division Ecorse, Detroit 29, Michigan

NATIONAL STEEL CORPORATION

You can hear it plainly—the familiar throbbing chorus of American Industry—of men and machines at work. Today, the sound carries a new urgency as factories step up production to meet the dual needs of the defense program and our civilian economy.

Daystrom's voice is a strong one in this industrial chorus. Our present backlog of defense orders exceeds $70,000,000. This is in addition to our civilian production.

American Type Founders, oldest Daystrom unit, is turning out 76-millimeter guns for General Walker Bulldog tanks and still continues to be the leading producer of printing equipment. Daystrom Electric Corporation is almost entirely converted to defense production—bombsights, recording equipment, aircraft subcontracting. Daystrom is building a $4,000,000 plant near Scranton, Pa. to manufacture an advanced type of Navy gun fire control system.

Meanwhile, other divisions of Daystrom are continuing to supply civilian needs. Plans for further expansion include a large plant, now nearly completed in Anaheim, Calif., to serve Daystrom's growing furniture market in the western states.

Such diversified production with central management control is the keynote of our business. Daystrom was planned and organized to carry on diverse activities, whether they be civilian or military.

DAYSTROM, INCORPORATED

(formerly ATF Incorporated) ELIZABETH, NEW JERSEY

The Daystrom family:

AMERICAN TYPE FOUNDERS, INC., Elizabeth, N. J. and Mount Vernon, N. Y. Letterpress, offset and gravure printing presses, foundry type and other graphic arts equipment.

DAYSTROM INSTRUMENT DIVISION, Plainfield, N. J. and Archbald, Pa. Manufacturer of defense materials.

DAYSTROM LAMINATES, INC., Daystrom, N. C. Producer of hard plywoods.

DAYSTROM FURNITURE, Eastern Division, at Olean and Friendship, N. Y. Produces chromed tubular steel and wood dinette sets.

DAYSTROM FURNITURE, Western Division, at Fullerton and Anaheim, Calif. Chromed tubular steel and wood dinette sets.

DAYSTROM ELECTRIC CORPORATION, Poughkeepsie, N. Y. Manufactures sound recorders and electronic instruments.

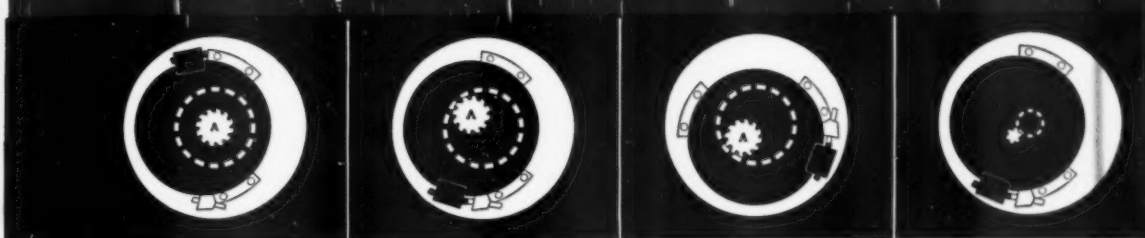
This advertisement is set in ATF type faces: Caslon No. 471, Palmer and Bernhard Modern Bold

Are You Doing PRECISION WORK at PRODUCTION SPEED?

Then You Will Perhaps PROFIT From Reading —

It contains very interesting information about precision metal-working at production speeds. Send for your copy today.

PLANETARY FORM AND THREAD MILLING— INTERNAL AND EXTERNAL—BY PLAN-O-MILL



The work (dotted white circle) does not revolve. Cutter is revolved around work.

For internal form and thread-milling, cutter (A) moves out from center to contact work.

Cutter moves in circle, completing cut; rapid reverse returns cutter to center.

For external milling, cutter moves in to contact work; then moves around work.

PLAN-O-MILL

REQUEST FORM

PLAN-O-MILL CORPORATION
1517 E. Eight Mile Road
Hazel Park, Michigan

Please rush my copy of: "SOLVED: The Production Up-Curve Mystery."

Name _____ Title _____

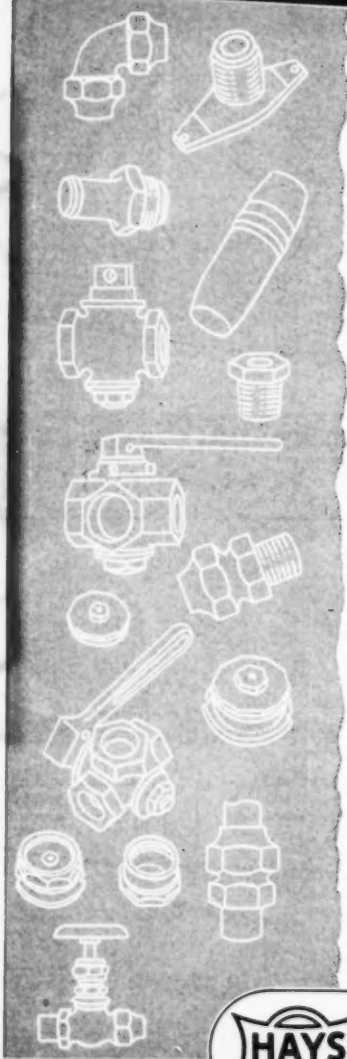
Firm _____

Address _____

City _____ Zone _____ State _____

HAVE YOU AN ORDNANCE PROCUREMENT PROBLEM . . .

HAYS IS A DEPENDABLE SOURCE OF SUPPLY FOR MACHINED BRASS AND BRONZE CASTINGS



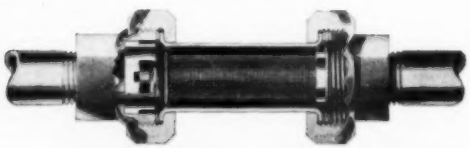
One of the nation's largest producers of machined brass and bronze castings . . . FACILITIES that include pattern department, brass foundries, precision machines capable of producing large quantity requirements . . . PERSONNEL of design, tool and production engineers and expert craftsmen with many years of service . . . REPUTATION for QUALITY that results from 80 years' experience in supplying the water and gas utilities, manufacturers in the appliance, industrial, and marine fields, and from producing material for the ARMY, NAVY, and AIR FORCE.

Submit your requirements with details, specifications, and delivery for prompt quotation.

HAVE YOU A WATER CONTROL PROBLEM . . .

The "MESURFLO" Control maintains even flow regardless of variable pressure

Automatically regulates flow at a predetermined rate — unaffected by variations in pressure . . . Subdues excessive pressure hammer and vibration . . . Installed like an ordinary union coupling . . . Permits use of simple timing mechanisms . . . Conserves water . . . Sturdy and simple in design . . . Accomplishments not duplicated at any cost.



ONE OF MORE THAN 3500 CATALOGED PRODUCTS MANUFACTURED BY HAYS

HAYS MANUFACTURING COMPANY
General Offices, Machining, Fabricating and Assembly Plant
803 12th Street, ERIE, PA.
Foundries: Erie, Pa., and Albion, Pa.

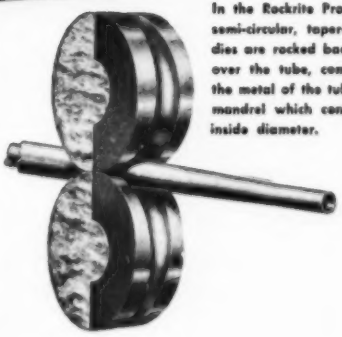
ROCKRITE® TUBING

Compression-sized for special ordnance needs!

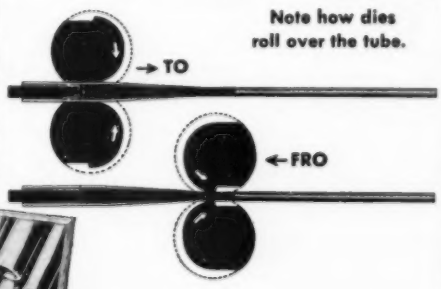
As shown in the diagrams at right, Rockrite Tubing is cold-sized by a proved process which sets entirely new standards for dimensional accuracy. As a result of this combination of cold forging and rolling work on the metal, Rockrite Tubing offers closer tolerances and a superior surface finish.

Rockrite Tubing can be machined into cylindrical and ring-shaped parts of better quality and at lower cost. Special bores and tapers can be produced accurately and economically. In addition, the mechanical properties of steel can be improved by the cold-working of the Rockrite Process.

HERE'S HOW



In the Rockrite Process, semi-circular, taper-grooved dies are rocked back and forth over the tube, compressing the metal of the tube against a mandrel which controls the inside diameter.

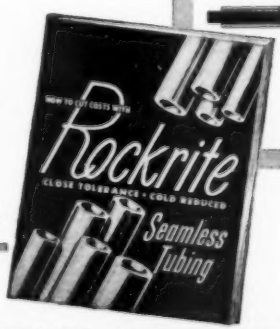


Note how dies roll over the tube.

TR-184

WRITE FOR YOUR COPY TODAY

There are many other important advantages of the Rockrite Process which are fully explained in new, 16-page illustrated Bulletin R2.



TUBE REDUCING CORPORATION · WALLINGTON, NEW JERSEY

you can be sure if it's AMP

Wire termination in military equipment can be just as important as each mission, each flight or each engagement. Successful operation depends on the proper function of every part. That's why AMP solderless terminals and precision installation tools are specified and approved for all critical installations. Write for new TECHNICAL DATA CATALOG and approval lists.

AMP PRE-INSULATED DIAMOND GRIP*
Solderless Terminal

U.S. Patent Nos. 2,410,321, 2,379,567, 2,405,111, 2,468,169, other U.S. Patents Pending.

AMP SOLISTRAND* Solderless Terminal

U.S. Patent No. 2,535,013, other U.S. Patents Pending.

*Trade-Mark
AMP Trade-Mark Reg. U.S. Pat. Off.

AIRCRAFT-MARINE PRODUCTS INC.
2100 Paxton Street, Harrisburg 3, Pa.

ANOTHER RED RING "First"

100" Gear Shaving Machine

The first gear shaving machine of its type ever built is the new Red Ring Model GCT which shaves both internal and external spur and helical gears with pitch diameters up to 100" and face widths up to 40". It is especially applicable to the large gears used in tanks, power shovels, mine hoists, speed reducers, stationary prime movers and marine drive units.

Outstanding characteristics of this machine are its high degree of accuracy in shaving large gears, its ingenious aids to rapid loading and unloading and the ease with which it can be set up.

Red Ring Shaving Machines are available for gears from ¼" to 200" in diameter.

Write for Detailed Description

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.
5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

This Trade Mark

·HECO·

on

ROCKETS • SHELLS • FUZES

and other ammunition metal components assures the armed forces of highest quality, delivery as promised and fair price.

HECKETHORN MANUFACTURING & SUPPLY CO.

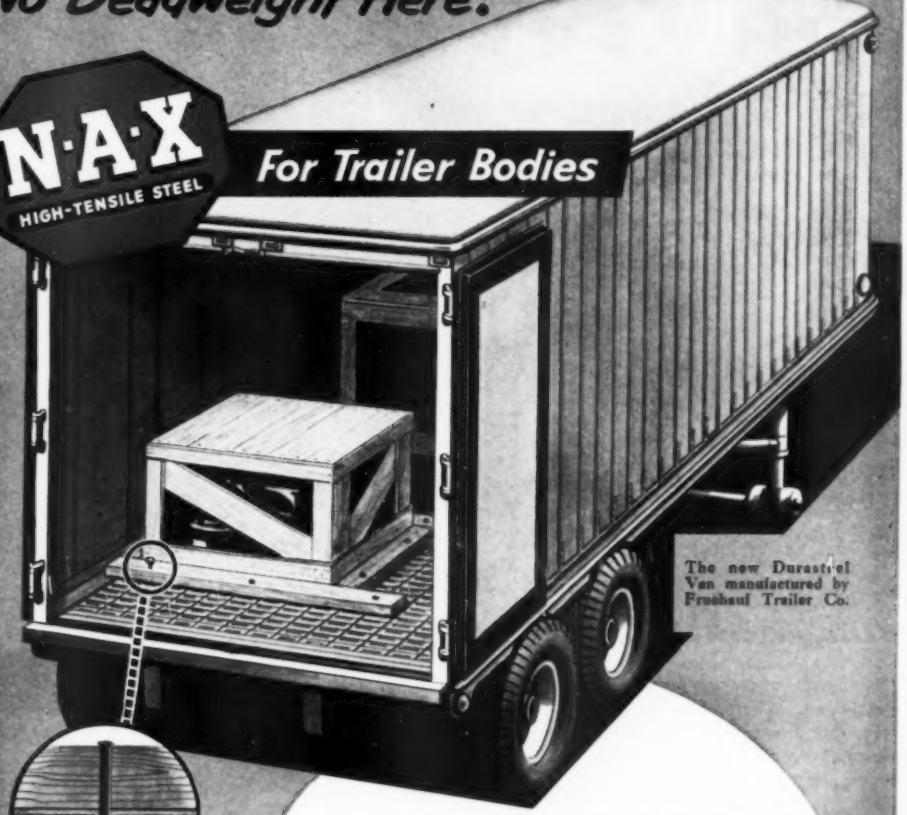
LITTLETON, COLORADO

Contractors to the United States Armed Forces for Rockets, Shells, Fuzes, Research and Development

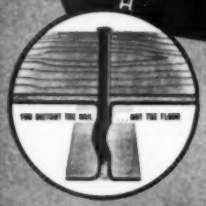
No Deadweight Here!

N·A·X
HIGH-TENSILE STEEL

For Trailer Bodies



The new Duraste·l Van manufactured by Fruehauf Trailer Co.



*Great Lakes' Strux-Steel Flooring has high strength and light weight. Its unique nailability permits safe blocking of loads. You distort the nail . . . not the floor.

America's first all-steel trailer body is on the highways—roof, sides, framing and flooring,* all of N-A-X HIGH-TENSILE steel. Years of planning, testing and research went into this unique trailer body, making it the most serviceable ever built.

1. The use of N-A-X HIGH-TENSILE steel in this equipment results in light weight with strength and durability.
2. In addition to greater strength, N-A-X HIGH-TENSILE steel has greater resistance to fatigue, impact, corrosion and abrasion. It offers a greater strength-to-weight ratio with longer life and larger payloads.

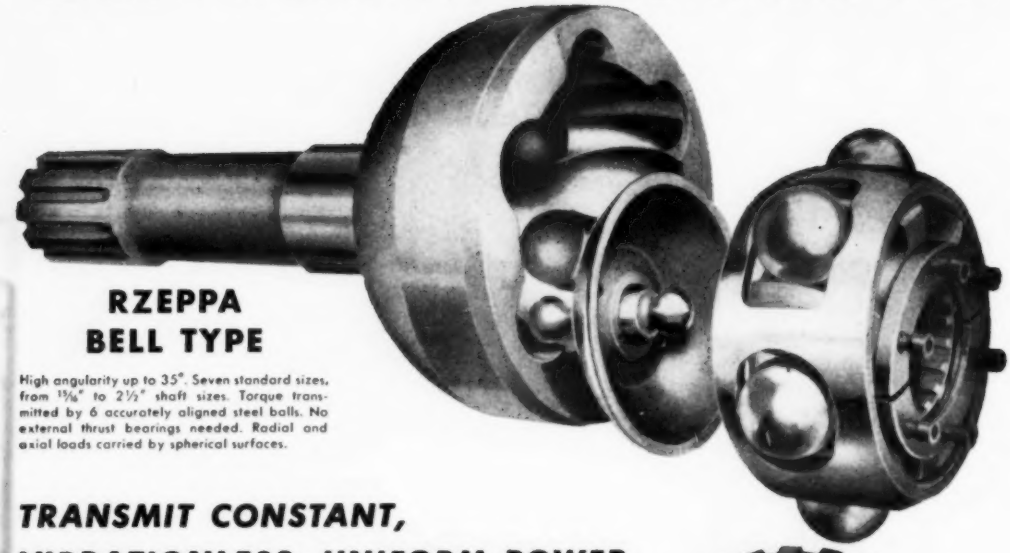
More and more of America's highway equipment manufacturers are swinging to N-A-X HIGH-TENSILE steel. Millions of on-the-job miles have proved the superior qualities of this steel . . . have proved its over-all economy.

GREAT LAKES STEEL CORPORATION
N-A-X Alloy Division • Ecorse, Detroit 29, Michigan

NATIONAL STEEL CORPORATION

SCRAP
STEEL

CONSTANT VELOCITY
UNIVERSAL JOINTS



RZEPPA BELL TYPE

High angularity up to 35°. Seven standard sizes, from 15/16" to 2½" shaft sizes. Torque transmitted by 6 accurately aligned steel balls. No external thrust bearings needed. Radial and axial loads carried by spherical surfaces.

TRANSMIT CONSTANT, VIBRATIONLESS, UNIFORM POWER

These joints offer ordnance and industrial design engineers true constant velocity—free from the alternate pulsations that set up vibration even at slight angularity and destructive force as angularity increases.

The field records of over two million Rzeppa joints in the several divisions of our armed forces prove their dependability. The Rzeppa joint consists of an outer driving member and an inner driving member, with a ball cage between them—all assembled into a concentric unit. Each of the six balls transmits torque by free rolling action. No tools are required to assemble the various parts which position each other securely by interlocking. The result is a joint combining great strength, high capacity, constant velocity, compactness, low friction losses and the utmost in dependability.

You are invited to discuss any problems concerning universal joints with our engineering staff, whose long experience in many fields is available to manufacturers of ordnance and industrial products.

RZEPPA DISC TYPE

For low angle operation. Capable of 18° deflection. Sizes from 1 7/16" O.D., taking 3/8" shaft and weighing 5 oz. to 10½" O.D., taking 3" shaft and weighing 62 lbs.

MANUFACTURED BY

The **GEAR GRINDING MACHINE CO.**

DETROIT 11, MICHIGAN

RZEPPA Constant Velocity Universal Joints

Deep-Drawn in 2 DRAWS with ADVANCE TOOLING

Depth Bomb part drawn with Advance Dies from 31½" steel blank.

THIS DIFFICULT STAMPING SIMPLIFIED BY NEW ADVANCE TOOLING METHOD

Here's another example of ADVANCE tooling ingenuity. The problem: This depth bomb tail piece deep-drawn to the dimensions shown above . . . in just two draws . . . from a 14-gauge steel blank. Similar pieces were formerly produced with five or six draws, or by butt-welding two halves.

Advance tooling techniques met the requirements — with dies that produced the part in two draws as specified. Advance can help you with your difficult drawing and stamping problems . . . and save you time and money in your processing operations. Our engineers and our completely equipped die plant are ready to serve you. Consult us — or write for complete information.

Write for Illustrated Descriptive Bulletin

ADVANCE DIE & TOOL CO.
6800 MADISON AVENUE
CLEVELAND 2, OHIO
PHONE: WOodbine 1-9191

• To Cut Costs . . .
• Speed Production . . .
• Improve Quality

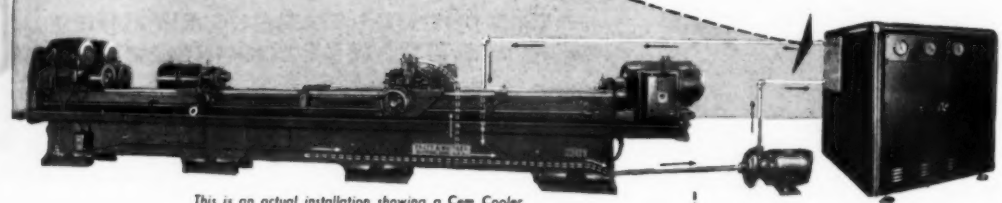
Cool your Cutting Oils

with a CEM COOLER!

With this self-contained cooling unit it is easy to hold cutting oil temperatures at practical working levels. Hot cutting oil is pumped from the machine through the Cem Cooler and returned to the machine at proper temperature for maximum efficiency.

One outstanding feature of the Cem Cooler is its ability to handle two jobs simultaneously. It is constructed with two separate cooling lines, and can be used with two machines at the same time even though each is using a different kind of oil.

Because the Cem Cooler Evaporator is constructed with all stainless steel tubing, it can be used safely to cool cutting oils without danger of corrosion. It is thoroughly suitable for use with any machining operation such as boring machines, drills, reamers, lathes, screw machines . . . in fact, any place where it is desirable to hold down the temperature of cutting oil.



This is an actual installation showing a Cem Cooler hooked up to a Pratt and Whitney deep hole driller.

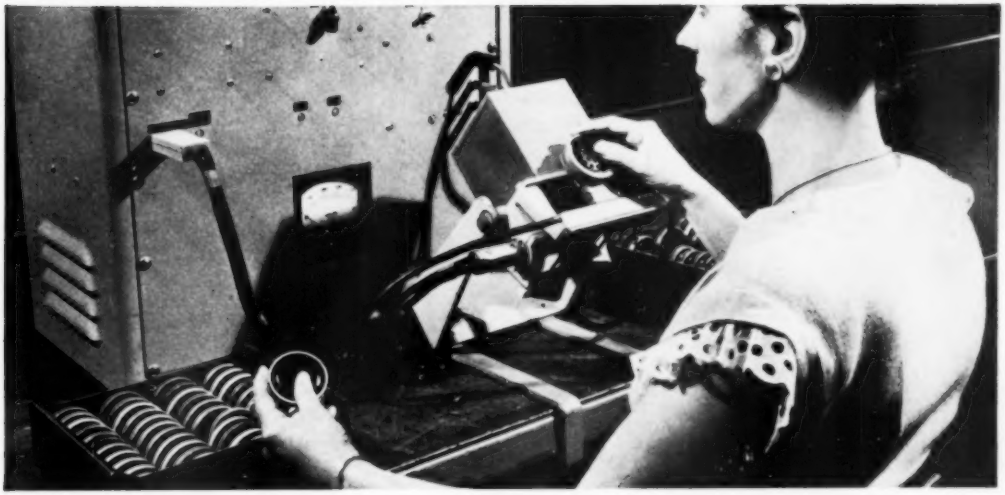
Use a Cem Cooler hook up with your equipment. You'll get these advantages right from the start.

- Closer Tolerances
- Better Work
- Increased Production
- Longer Tool Life

Write today for detailed information about the Cem Cooler and its adaptability to specific jobs in your shop.

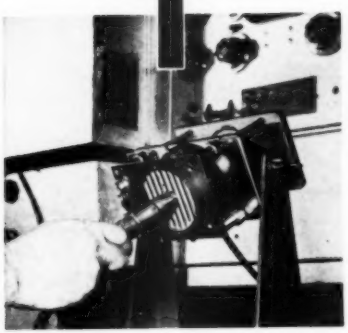
CROWN CORK & SEAL COMPANY

Contract Division • Baltimore 3, Maryland



This Western Electric employee mounts a transmitter in the test fixture which is swung down to face an artificial mouth at 45-degree angle, just as transmitters are held in use. More than a million transmitters are tested each year.

This mouth speaks to millions



At Bell Laboratories a scientist emp'oys a condenser microphone to check the sound level from another type of artificial mouth, used in transmitter research.

To serve the changing needs of telephone subscribers millions of telephone sets have to be moved each year. Before being put back into service most of them are returned to the Western Electric Company's Distributing Houses where they receive a thorough checkup.

Western Electric engineers needed a rapid method of testing transmitters over a range of frequencies. At Bell Telephone Laboratories, scientists had just the thing—a technique they had devised for fundamental research on transmitters. In co-operation with these scientists, Western Electric engineers developed the practical tester in the illustration.

The transmitter is removed from the handset and put in front of an artificial mouth which emits a tone that swings several times per second over a band of frequencies. A signal lamp tells whether the transmitter is good. Each test takes 5 seconds.

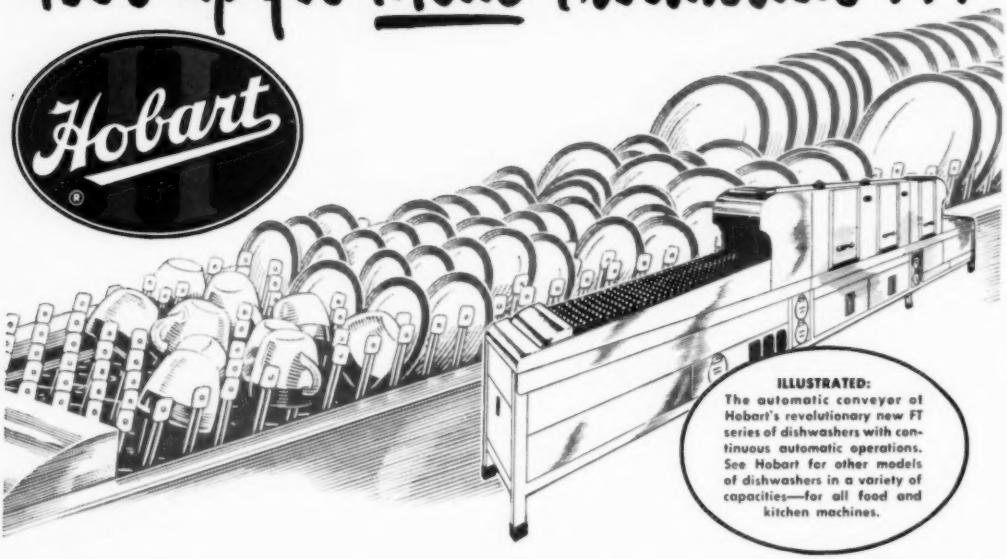
This new tester illustrates how Bell Laboratories research and Western Electric manufacturing skill team up to maintain your telephone service high in quality yet low in cost.

BELL TELEPHONE LABORATORIES

• EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

Tool Up for Meal Production . . .

Hobart®



ILLUSTRATED: The automatic conveyor of Hobart's revolutionary new FT series of dishwashers with continuous automatic operations. See Hobart for other models of dishwashers in a variety of capacities—for all food and kitchen machines.

With Hobart Food, Bakery and Kitchen Machines Already Tooled for the Job

Unnecessary hand methods are just as wasteful in the kitchen as on certain production line jobs—all high cost and low output. Yet the preparing and serving of meals in mass is essentially a manufacturing procedure, and must be so assessed for efficiency of operation.

HOW THEN TO BEST SOLVE the problems of mass feeding? Easy! Tool up your kitchen with Hobart machines—the most comprehensive line of food and kitchen machines in the world. Tool up to convert raw food materials into meals with Hobart meat saws, slicers, tenderizers, choppers, mixers, peelers, scales, food cutters and coffee mills. Tool up for production methods in sanitation with Hobart dishwashers, dish scrappers and glasswashers. Only with Hobart can you plan complete assembly line methods, with models specified in your correct capacities.

Ask for recommendations from your convenient Hobart representation. Through it you consolidate planning, installation and maintenance for a complete streamlined installation—all machines backed by the Hobart guarantee. Just phone locally—or write the factory . . . *The Hobart Manufacturing Company, Troy, Ohio.*

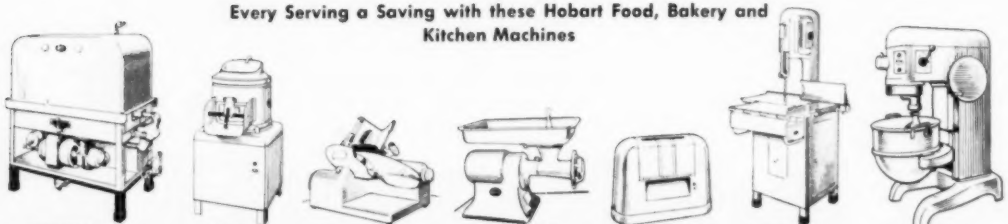
Write for Booklets 1-150-B and 2-250-B

Hobart
Trade Mark of Quality for over 50 years

Hobart *Food Machines*

The World's Largest Manufacturer of Food, Bakery and Kitchen Machines

Every Serving a Saving with these Hobart Food, Bakery and Kitchen Machines



DISHWASHERS | PEELERS | SLICERS | CHOPPERS | TENDERIZERS | MEAT SAWS | MIXERS

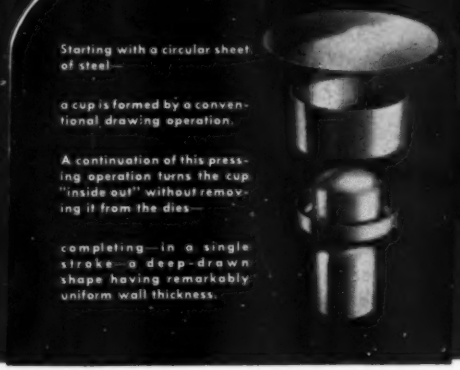
use

Scaife

REVERSE-DRAWN SHAPES

To: SAVE WEIGHT
GAIN STRENGTH
REDUCE COSTS

Made by the revolutionary reverse-draw process, Scaife deep-drawn metal shapes have the improved physical properties, desirable uniformity of wall thickness and other characteristics that are important in reducing weight and increasing strength. The process is ideal for pressure vessels, for other deep-drawn shapes such as rocket and missile bodies and tubes, and for a great variety of containers and enclosures. A brief description of the process is given below. Scaife engineers will be glad to work with manufacturers using or planning to use deep-drawn shapes.


Starting with a circular sheet of steel—
a cup is formed by a conventional drawing operation.
A continuation of this pressing operation turns the cup "inside out" without removing it from the dies—
completing—in a single stroke—a deep-drawn shape having remarkably uniform wall thickness.

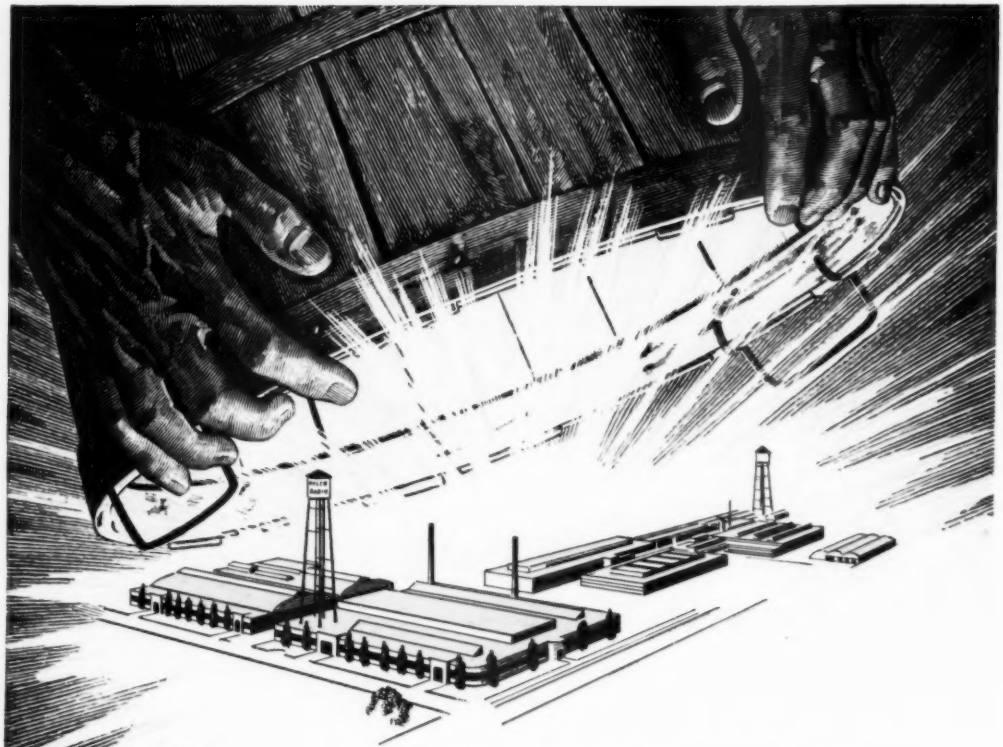
The Scaife Reverse-Draw process is suitable for the production of shapes having cross-sections that are symmetrical. They can be made with one end completely closed and with the other end flanged or straight. Shapes can be formed of ferrous and non-ferrous materials. We will be glad to have your inquiries regarding deep-drawn shapes up to 36 inches in diameter, with wall thicknesses up to ¼ inch.

FOUNDED 1902

Scaife Company

OAKMONT (PITTSBURGH DISTRICT), PA.

Makers of Pressure Vessels for Air, Gases, Liquids



WE'RE LIFTING THE BUSHEL BASKET— AND LETTING OUT OUR LIGHT!

Probably you didn't know it because we haven't told you. BUT—for the past five years we've been building car and truck radios for General Motors. In 1950 alone we built nearly 2,000,000 radios for practically all types of vehicles. Our production tops that of any other car radio manufacturer.

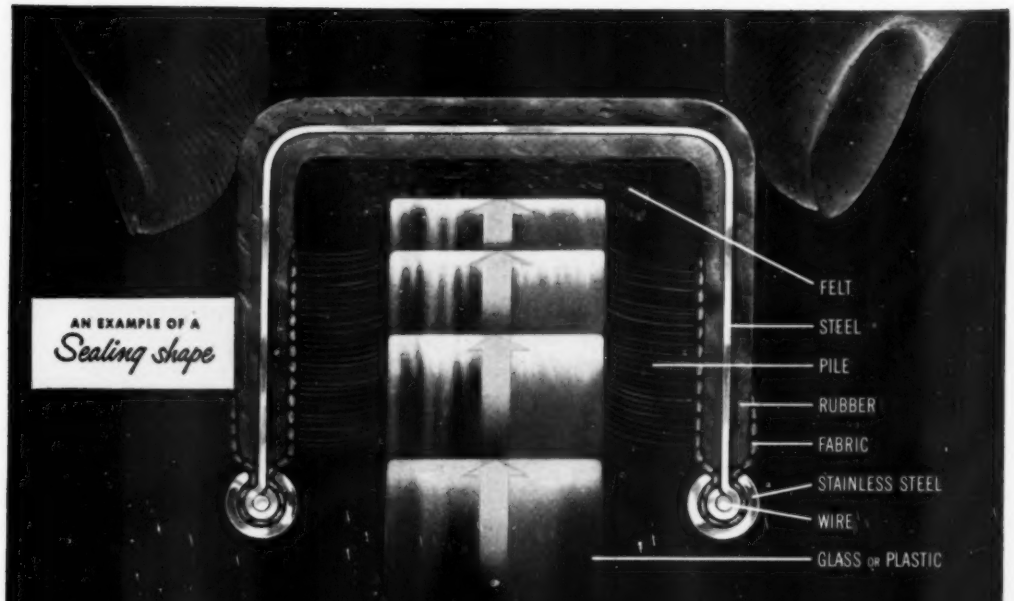
Since we stopped making radio and electronic equipment for the armed forces during World War II, we've concentrated on making our facilities the largest and our products the finest in the industry. Unlike most others, we're not just an assembly plant. We make practically all the parts that go into our products. Our design and research engineers are tops in their field. Our laboratory and production equipment is the finest that can be obtained.

With our vast experience, our facilities, engineering know-how, our productive manpower bigger and better than ever before, we believe we can be of service to our country. We are ready to go to work immediately for national defense and count it a privilege to volunteer for service.

Delco Radio

DIVISION, GENERAL MOTORS CORPORATION

KOKOMO, INDIANA



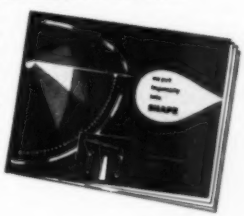
if it needs a special shape to seal, guide or protect, we can design it...mass produce it...economically

Think about your product. Does it have a panel, door or window that slides, glides or swings? Does it require a seal to protect against moisture, heat, cold, dust, or air leakage? Does it need some type of channel to guide its motion?

We design and mass produce ingenious *shapes* or complete assemblies to do such jobs. We do this by forming metal, rubber or fabrics . . . and bonding them together permanently by unique construction and processes. We stamp metals to unusually close tolerances, injection-mold plastics in any shape desired. And we can do it at very low cost!

Such techniques have helped us become the world's largest producer of the window channel and weatherstrip which seal your automobile against moisture, dust and cold.

If this specialty of ours suggests an idea for improving your product or reducing its cost, we'd like an opportunity to discuss it with you. Or write for a copy of our new booklet, "We Put Ingenuity into SHAPE".



THE MARK OF A SUPERIOR PRODUCT

The Standard Products Co.

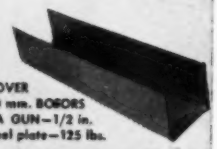
DEPT. E. GENERAL OFFICES: 2130 WEST 110 STREET • CLEVELAND 2, OHIO

WE PUT INGENUITY INTO SHAPE

Creative METAL STAMPINGS

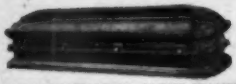
Save METAL - TIME - COST
for Prime Contractors of products for the Armed Services

A few of the many military metal stampings produced by the LEAKE organization



COVER
40 mm. BOFORS
AA GUN—1/2 in.
steel plate—125 lbs.

ELECTRICAL CONNECTOR LUG
Heavy Gauge
Copper
Tubing



RADIO PROXIMITY
FUSE HOUSINGS
SIGNAL CORPS—
Silver Brazed
Assembly

QMC REPATRIATION CASKET STAMPINGS:
Lid, Body, Base, Moldings, Rings, Plates, Clips

USAF NAPALM BOMB BAFFLES
.102" x 52S-0 Aluminum

COLD EXTRUDED CUPS
Steel Cartridge Cases

ORDNANCE
CAPACITOR
CAN—Deep
Drawn Brass

NAVAL OIL FILTER SHELLS
Deep Drawn Brass and Steel

HALF TRACK GUIDE
& CROSS PLATES
SAE-4140 Steel

ORDNANCE
BOOSTER CASINGS

AIRCRAFT ALUMINUM
WHEEL FAIRINGS

HEAD & BASES
FRAGMENTATION BOMBS
21,000 each daily

MAIN BEARING
AIRCRAFT ENGINE

ORDNANCE BOMB FUSE
ADAPTER — 5/16-in. Drawn
Steel Plate

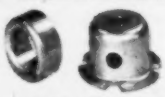
40 mm. BOFORS AA GUN:
Stamped Brass Components

TANK SEAT BACK STAMPING

IDLER WHEELS FOR TANKS
1/4-in. steel — 15-in. dia.

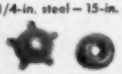
TIMER HOUSING — NAVAL
DEPTH CHARGE — Deep
Drawn Naval Brass and Steel

"WATER BUFFALO" STAMPINGS
Heavy Gauge SAE-4130 Steel



INCENDIARY BOMB STAMPINGS
CHEMICAL WARFARE BRANCH

AERIAL DEPTH
CHARGE STAMPINGS



BASE PLUG FOR 20 mm.
SHELL — .550" dia.
x .114" thick steel

SERUM BOTTLE HOLDER
ARMY MEDICAL DEPARTMENT

AIRCRAFT SUPERCHARGER
BEARING SAE-4145 Steel

HEAVY GAUGE TANK STAMPINGS

CONVERSION BOOKLET

28 pages... 32 illustrations of creative metal stampings produced by modern LEAKE techniques for military and civilian purposes. Single copies free when requested on your letterhead. Quantities at nominal cost.

THE LEAKE ORGANIZATION *can furnish metal stampings in* ANY SIZE • ANY THICKNESS • ANY SHAPE • ANY ANALYSIS

THE LEAKE STAMPING COMPANY · MONROE, MICHIGAN

LEAKE

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COMPLETE PRESSROOM—MACHINE SHOP
HEAT TREAT—BRAZING—WELDING
TESTING AND INSPECTION

Strengthening

the ***production*** *arm of the nation...*

IN the factories of car builders, engine builders and other American industries, special SUN Testing Instruments are adding muscle to the nation's production arm. Finer, more efficient vehicles, engines and other machinery are being produced with substantial savings in time, costs and manpower by substituting "Testwork" for "Guesswork" with these SUN Precision Instruments.

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Literally thousands of SUN Precision Testing Instruments are built yearly to supply American industrial, military and governmental needs. SUN welcomes the opportunity to apply its long years of experience in the precision testing instrument field to help solve problems that will further strengthen the production arm of the nation.

SUN

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ELECTRIC CORPORATION

6371 Avondale Avenue, Chicago 31, Ill.

SUN Diagnosis Service and Equipment is familiar to many millions of American motorists and servicemen across the nation. Over 300 SUN Field Representatives assure the efficiency of this service by training mechanics, servicing equipment and guiding Diagnosis Procedures. In addition, 17 strategically located SUN Technical Training Schools provide specialized advanced training for "key" operators.

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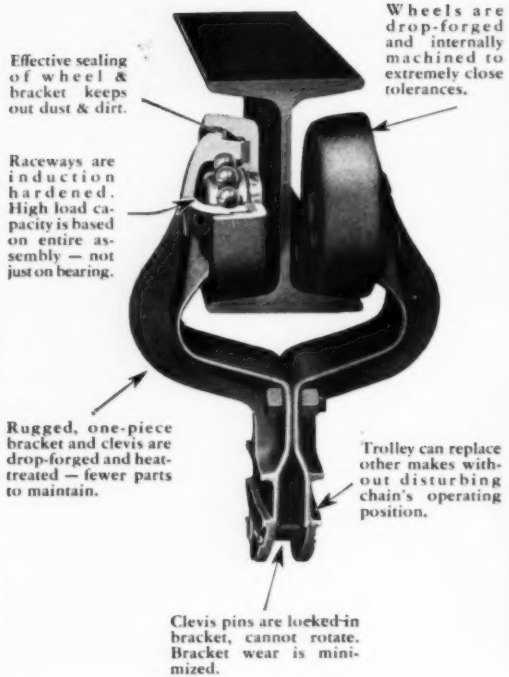
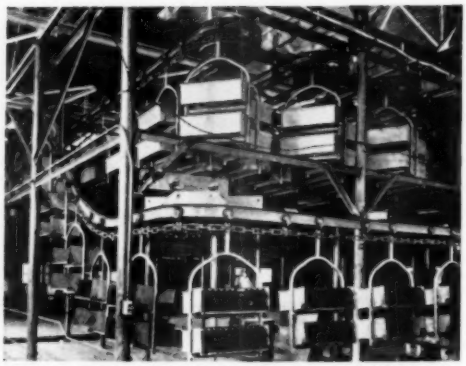
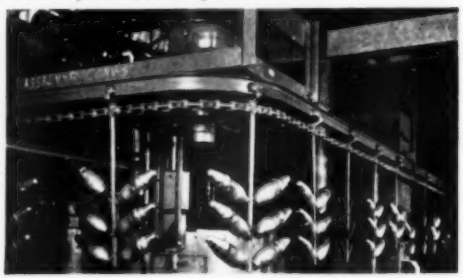
When you buy TROLLEY CONVEYORS why not get BOTH?

Superior components PLUS Engineering ingenuity


Effective sealing of wheel & bracket keeps out dust & dirt.
Wheels are drop-forged and internally machined to extremely close tolerances.
Raceways are induction hardened. High load capacity is based on entire assembly — not just on bearing.
Rugged, one-piece bracket and clevis are drop-forged and heat-treated — fewer parts to maintain.
Trolley can replace other makes without disturbing chain's operating position.
Clevis pins are locked-in bracket, cannot rotate. Bracket wear is minimized.



Building 3.5-inch rockets, modern version of World War II bazooka, with the help of Link-Belt Overhead Trolley Conveyors. This parts storage conveyor, 600 feet long, has 180 carriers, spaced 40 inches apart.



Steel bodies for these 3.5-inch rockets are carried on this 112-foot-long Link-Belt Overhead Trolley Conveyor. The carriers, spaced 30 inches apart, were also made by Link-Belt.

You can make your overhead trolley conveyor dollars go farther by calling in Link-Belt while you're still in the planning stage. Link-Belt makes the finest trolley on the market today. Equally important, our specialists can draw on the world's largest, most varied background of conveying and power transmission application.

Bringing parts to workers and taking them away. Drawing raw materials from stock at correct intervals. Synchronizing operations to eliminate bottlenecks.

Link-Belt Overhead Trolley Conveyors do all these jobs to release valuable manpower for productive work . . . to increase output. And they free floor space, too.

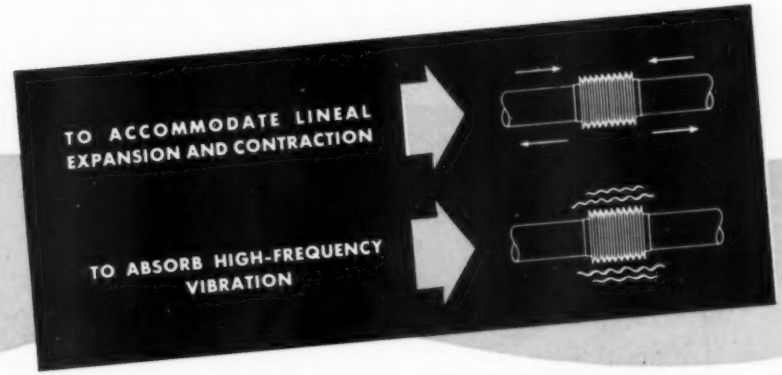
Why not have a Link-Belt engineer help you and your consultants plan peak production results? Write for Book 2330 for all the facts.

LINK-BELT

OVERHEAD TROLLEY CONVEYORS

LINK-BELT COMPANY: Chicago 8, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities. 12,451-A

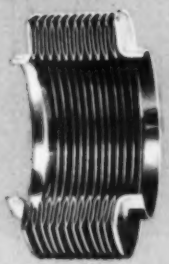
Here's An Easier, Better Way



Titeflex EXPANSION-TYPE BELLOWS

Why easier? Because Titeflex bellows are simple to insert in the line . . . and because they are packless and require no maintenance. **Why better?** Because they do not weaken the lines in which they are inserted . . . they do not reduce flow rates . . . yet they do a *real job* of absorbing motion.

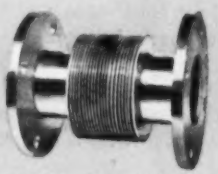
Titeflex bellows are available in plain steel, stainless, Monel and Inconel to meet most heat, pressure and corrosion requirements. Sizes from 1" to 5" I.D. are standard . . . but we welcome inquiries for larger sizes. And we can supply them with extra-high convolutions for more flexibility . . . with extra-thick walls for more strength. Complete Titeflex engineering facilities are available without obligation to help you determine the type that will best fill your specific needs. Write us today for full details.



Cross-sectional view of Titeflex bellows, showing how welded construction results in unvarying wall thickness throughout. This enables the bellows to withstand constant high pressures without distortion. Since convolutions can be supplied as high as desired, varying degrees of flexibility within a given lineal distance may be obtained.

TO OBTAIN SPECIFIC RECOMMENDATIONS

Our engineers will be glad to recommend types and sizes. Send us the following data: Pipe sizes and materials; material conveyed; temperature, pressure and corrosion conditions; expansion values; vibration rate and intensity; type of flanges, if any.



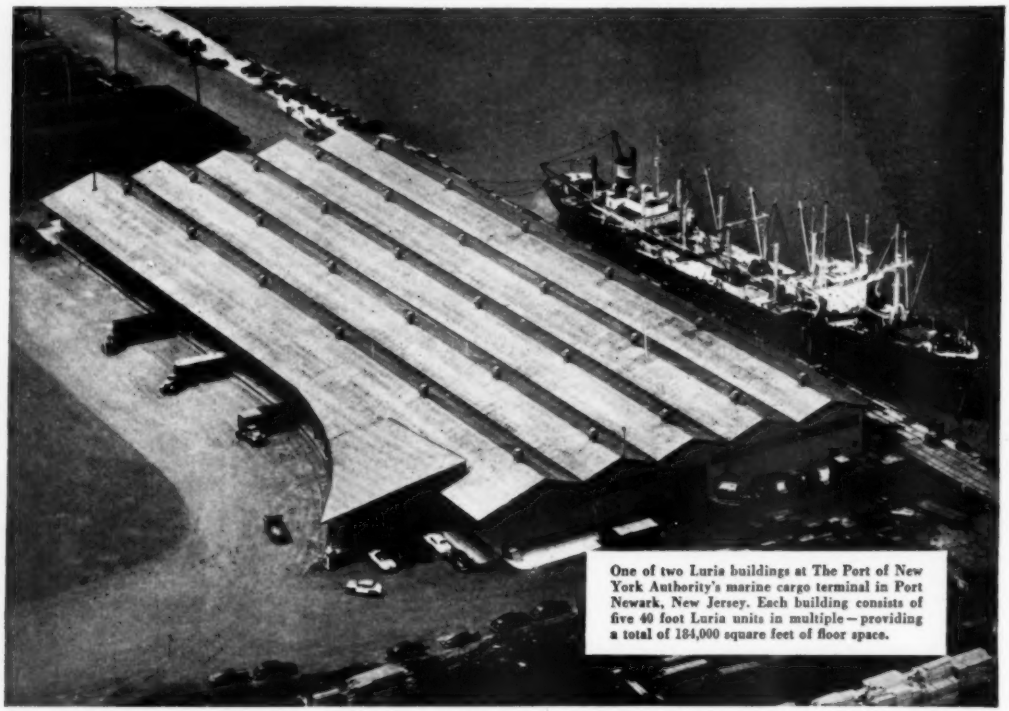
Titeflex bellows fitted with large-diameter flanged ends. Special end fittings can be supplied as required.

Titeflex, Inc.

512 Frelinghuysen Ave., Newark 5, N. J.

FLEXIBLE METAL HOSE SPECIALISTS FOR MORE THAN 30 YEARS

MEETING TODAY'S BUILDING NEEDS
With an Eye to the Future



One of two Luria buildings at The Port of New York Authority's marine cargo terminal in Port Newark, New Jersey. Each building consists of five 40 foot Luria units in multiple—providing a total of 184,000 square feet of floor space.

For rugged permanent construction with lasting economy you can't beat Standard Buildings by LURIA

This is a bird's eye view of a large multiple unit Luria building — used as a marine cargo terminal for The Port of New York Authority. This same rugged, permanent structure would serve equally well as a railroad freight terminal, a distribution warehouse, or a manufacturing plant. In fact there's practically *no limit* to the building requirements that can be met so easily and economically with Standard Buildings by LURIA.

One look at a Luria building tells the story of its rugged, permanent construction. The heavy steel frame, with strong, rigid, all-bolted field connections, puts extra years of life into every Luria building—whether it has a low-cost covering or built-up roof with masonry walls. This is your assurance of real long-range economy — a structure that's built for the *years ahead.*

Luria Standard Buildings save time, effort and expense all along the line—from planning and cost estimating to procurement, fabrication and erection. Standard designs, utilizing standard structural members, fabricated by standardized manufacturing methods — that's Luria's answer to the ever increasing problem of high building costs.

For the complete story, send for your free copy of our new 20-page catalog on Standard Buildings by Luria.

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MOTOR PRODUCTS CORPORATION

MEETS EMERGENCY DEMANDS FOR VITAL STAMPINGS WITH

DANLY PRESSES

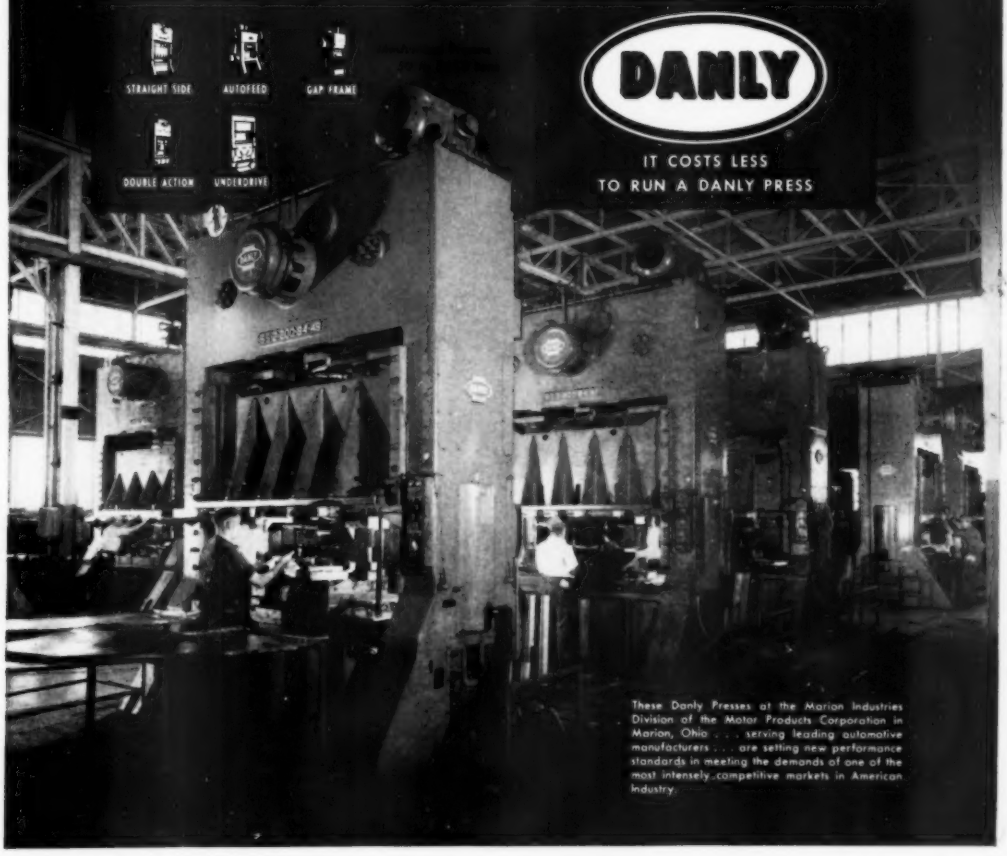
With today's emphasis on increased industrial output and tight delivery schedules, machine tools must operate for sustained periods at maximum output. This is particularly true of presses which so often set the pace for an entire production operation.

That's why you find Danly Presses . . . complete lines of them like the ones shown here . . . in so many of the country's biggest plants.

Danly features like the exclusive Danly Cool-Running Clutch, automatic lubrication and extra rigid construction assure longer uninterrupted production runs, less costly down time.

Call a Danly Press Engineer today and see how the extra capacity of Danly Presses will help solve your production scheduling problems.

DANLY MACHINE SPECIALTIES, INC., 2100 South Laramie Avenue, Chicago 50, Illinois



These Danly Presses at the Marion Industries Division of the Motor Products Corporation in Marion, Ohio . . . serving leading automotive manufacturers . . . are setting new performance standards in meeting the demands of one of the most intensely-competitive markets in American industry.

Trial by Torture

LIFE is too short to determine the useful life of our ball bearings under normal conditions. That is why we *accelerate* tests, by overspeed, overload, extremes of temperature, by running, under every conceivable condition of operation, day and night, year after year.

Around the clock, our engineers continue the research that has made the best bearings of yesterday even *better* bearings today.

Forty years of this searching have given us a wealth of experience that should be helpful to you. No need for trial and error. We've been all through that, for your benefit.

Nothing Rolls Like a Ball...

NEW DEPARTURE

BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT

149

Either Way – YOU'RE ON THE ROAD TO BETTER POWER BRAKING!

There's no need to be puzzled about the question of efficient power braking for *any commercial vehicle*. Where the preference is for a hydraulic system, Hydrovac, with over two and a half million installations, has proven itself the undisputed leader in its field. And for vehicles where air actuated brakes are the choice, the new Bendix Air-Pak air-hydraulic power braking unit is foremost in its field.

Air-Pak, similar in design and principle to the Hydrovac, changes air pressure into hydraulic pressure by means of two direct connected pistons, thus combining all the well proven advantages of hydraulic brake action with an air brake system.

Products of twenty-five years of practical braking experience, these outstanding power braking systems offer faster, more positive and better controlled braking. And in both the vacuum and the air actuated units, brakes can be applied instantly by foot power alone—a safety factor of tremendous importance. Remember, regardless of size of vehicle or whether your preference is for vacuum or air actuated brakes, for the industry's finest power braking systems—specify Bendix® Hydrovac® or Bendix Air-Pak.

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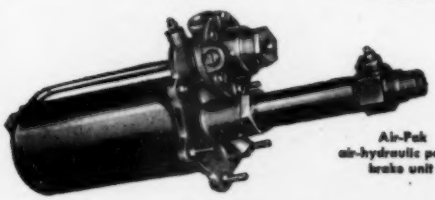
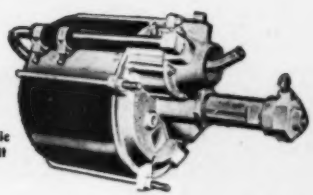


Air-Pak air-hydraulic power brake unit



Hydrovac vacuum-hydraulic power brake unit

BRAKING HEADQUARTERS for the AUTOMOTIVE INDUSTRY

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Export Sales: Bendix International Division, 72 Fifth Ave., New York 11, N.Y. • Canadian Sales: Bendix-Eclipse of Canada, Ltd., Windsor, Ontario, Canada

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60

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are ready to serve you!

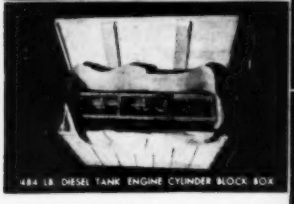
ALL FULLY INFORMED ON SPECIFICATIONS AND REQUIREMENTS OF ALL GOVERNMENT BRANCHES

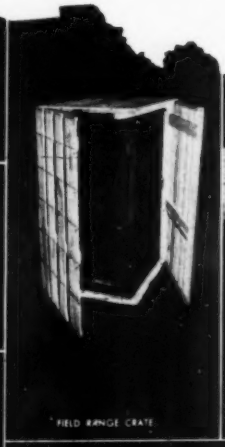
Strategically located to serve suppliers of all government services, Wirebound Box manufacturers are in excellent position to meet your shipping container needs. Parts boxes, equipment crates, over-packs and food containers are but a few of the multitude of uses for which Wirebound containers are adaptable. Wirebound manufacturers are informed, experienced and technically trained to design, produce and pre-test scientific containers for each use. Make it a point to consult your nearest Wirebound supplier or write for full information.

Wirebound Box Manufacturers Association
Room 1163, 327 South LaSalle Street, Chicago 4, Illinois

CYLINDER BOX

IMMERSION HEATER BOX

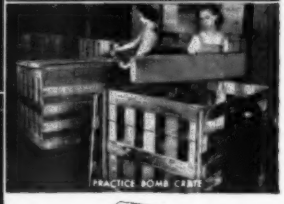

484 LB. DIESEL TANK ENGINE CYLINDER BLOCK BOX


FIELD RANGE CRATE

CHEMICAL BOMB BOX

TYPICAL WIREBOUND OVERPACK

PROJECTILE BOX


PRACTICE BOMB CRATE

Wirebound
BOXES & CRATES
Users names on request

and gages too!

Yes, only GREENFIELD with its GEOMETRIC Division manufactures in its own plants, a complete line of Cutting Tools plus Gages! Yes, only GREENFIELD could duplicate the above tooling and top it off with all necessary Gages.

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	Capacity From	Capacity To		Capacity From	Capacity To
TAPS and COLLAPSING TAPS...	0-80	8½"-8	DRILLS.....	#80	3½"
DIES and DIE HEADS.....	0-80	6"-7	REAMERS.....	7/0	2½"
GAGES—THREAD.....	0-80	1½"-6	END MILLS.....	1/16"	2"
GAGES—PLAIN.....	.059"	4.510"			

BUY TOOLS WITH **CONFIDENCE** BUY **GREENFIELD** TOOLS

GREENFIELD TAP AND DIE CORPORATION

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POWER BRAKING
ASSURES *Feather touch* CONTROL

Today's most advanced development in power braking is Kelsey-Hayes amazing "VACDRAULIC", forerunner of even more startling Kelsey-Hayes developments for tomorrow's motor cars.

Kelsey-Hayes "Vacdraulic" is the only unit to power the brake action instantaneously, with perfect "feather-touch" control, assuring perfect "pedal feel" in direct proportion to the pressure applied. Kelsey-Hayes "Vacdraulic" cuts foot pressure by as much as two-thirds that required for ordinary brakes!

"Vacdraulic", the only unit utilizing complete hydraulic control with a fixed reaction ratio, insures perfect "feather-touch" control at all pressures.

NOW! . . . Kelsey-Hayes "Vacdraulic" power brakes are standard equipment on over 100,000 cars of one of the world's leading automotive manufacturers. (Kelsey-Hayes engineers will gladly consult with you on the superior advantages of VACDRAULIC POWER BRAKES as original equipment on your new cars.)

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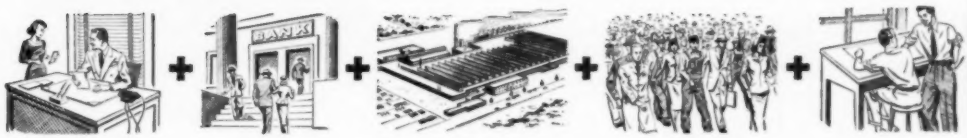
PRODUCTS: Wheels—Hub and Drum Assemblies—Brakes—Vacuum Brake Power Units—for Passenger Cars, Trucks, Buses—Electric Brakes for House Trailers and Light Commercial Trailers—Wheels, Hubs, Axles, Parts for Farm Implements.

PLANTS: Kelsey-Hayes Plants in Michigan (4); McKeesport, Pa.; Los Angeles, Calif.; Davenport, Iowa; Windsor, Ontario, Canada.

What it takes to cool a tank engine!



Our Armed Services wisely leave this "assembly job" to private industry. When seeking prime contractors, they look for companies which can best serve as industrial "clearing houses" for the thousands of different skills necessary to build modern weapons.

The company selected must then evaluate and use the skills of thousands of sub-contractors. A typical prime contractor, now engaged in building tanks, issues over 17,000 sub-contracts distributed among 5,000 separate firms! As one of these firms AMF is producing cooling fans for Army tanks.

AMF is proud to be a part of this system, both as a prime contractor and as a sub-contractor. In either capacity, we feel our *skill* and *speed* is best utilized to help keep America militarily strong and economically sound.

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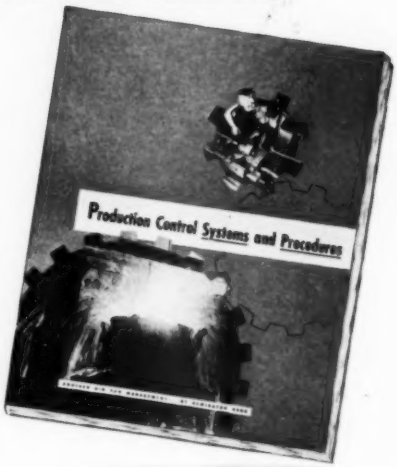
new book explains

Practical Production Control



Most of your manufacturing problems today can be summed up in two words – *materials* and *production.*

The answer to these problems lies in simplified and proved paper work systems. That's why we know our new book, "Production Control Systems and Procedures," can be a standard guide to material and production planning and control in your plant, whether it is large or small.

This book outlines actual case histories based on the vast combined experience of practical men who solved the complex production control problems of a regulated economy. These men now bring you, free, their analysis of simplified means for coordinating men, materials, and machines.

Here are a few of the practical ideas you will find in this book . . .

. . . How to keep up maximum output, curb costly production delays – by using SCHED-U-GRAPH CHART BOARDS to set up long-range, flexible production schedules, and to provide positive control of machine loads and parts needed for assembly-line operations.

. . . How to detail advance requirements of parts and raw materials for effective procurement action – with PUNCHED-CARD TABULATION SYSTEMS that "explode" bills of materials mechanically, quickly; and also provide the facts needed to prepare CMP allotment applications.

. . . How to maintain coordinated control of requirements, advance ordering, receipts and inventory of each item of parts and raw materials – in KARDEX VISIBLE CONTROL SYSTEMS that flash positive warning of threatened shortages or overstocks, so that prompt corrective action may be taken.

"Production Control Systems and Procedures", Form No. X1268, will show you how these proved ideas can help solve your production control problems. For your free copy, phone our nearest Business Equipment Center. Or write to Room 1471, Management Controls Reference Library, Remington Rand Inc., 315 Fourth Avenue, New York 10, N.Y.

Remington Rand

Imagine! Armor plate of any thickness

flame-cut to ± 1/16" Tolerance

ONLY THE ACETOGEN PROCESS OFFERS THESE STARTLING ADVANTAGES:

- Armor plate of all thicknesses flame-cut to ±1/16" tolerance!
- The flame-cut plates are ready for welding without grinding, finishing, bridging, or beading!
- Single- and multi-bevels are as easy to flame-cut as square-edges!
- Flame-cut plates have "feather" edges . . . surfaces have sufficiently low Brinell to allow machining!
- No heavy investment needed; the Acetogen Process utilizes standard, readily-available, low-cost equipment and tools!
- Experienced flame-cutters become qualified Acetogen operators within a few days!

AND THAT'S JUST ONE of the many amazing facts about the Acetogen Process—the only really new flame-cutting development in years!

The Acetogen Process now makes *complete* plate-edge preparation possible *with a flame!* It saves vital man-hours by eliminating most of the grinding, finishing, beading, and bridging formerly necessary. It makes *precision* flame-cutting a reality!

Acetogen Fabricators are proving these statements *today* in the Philadelphia plant of Henry Disston & Sons, Inc.—doing a job that industry thought couldn't be done. They are turning out thousands of armor plates—each one precisely cut, each one duplicating its pattern to within 1/16th of an inch! This work is a source of continual satisfaction at Disston, and Baldwin-Lima-Hamilton, where the plates are assembled.

We can produce results just as eye-opening in *your* plant. We have the gas and nozzles, and the personnel with the "know-how"; we will act either as consultants, or as sub-contractors doing the job in your plant. We invite your inquiry. Acetogen Fabricators, Inc., 822 Commercial Trust Bldg., Philadelphia 2, Pa.

ACETOGEN

Originators of precision flame-cutting

FABRICATORS, INC.

hauls
bulldozes
seals
compacts
hoists

"CAT" DW10 ON THE DOUBLE!

HERE's a fast stepper that can do a lot of different jobs on the double. It's the "Caterpillar" DW10, built to keep right on moving under conditions that slow down less sturdy rigs. Equipped with a "Cat" No. 10 Scraper or W10 Wagon, it first made a name for itself as a big producer on long hauls. But soon word got around that you could get good use out of it other ways, too. What other ways? With a "Cat" Bulldozer, it's a powerful 'dozing tool. With a trailing water wagon, it moistens fill to effect bindage. With a boom, it handles bulky material efficiently. And with sealing rollers, it compacts fill to specified moisture content. The power's there to take these and other jobs in stride—an honest 115 hp. at the drawbar!

Machines, like men, are judged by *what they do*. When you look over on-the-job reports about the "Cat" DW10, you'll see that it delivers with a minimum of down-time wherever it goes—North, East, South or West—at home or overseas. Rugged, reliable and versatile, it's a rig that will help make a good record for your outfit!

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

CATERPILLAR

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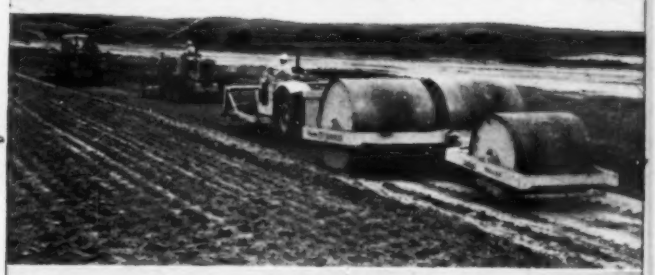
DIESEL ENGINES • TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

LONG HAULS
call for speed plus big capacity — you get both in the "Cat" DW10 with "Cat" No. 10 Scraper—or W10 Wagon. This equipment's on the job for A. B. Burton & Co., Lynchburg, Virginia.

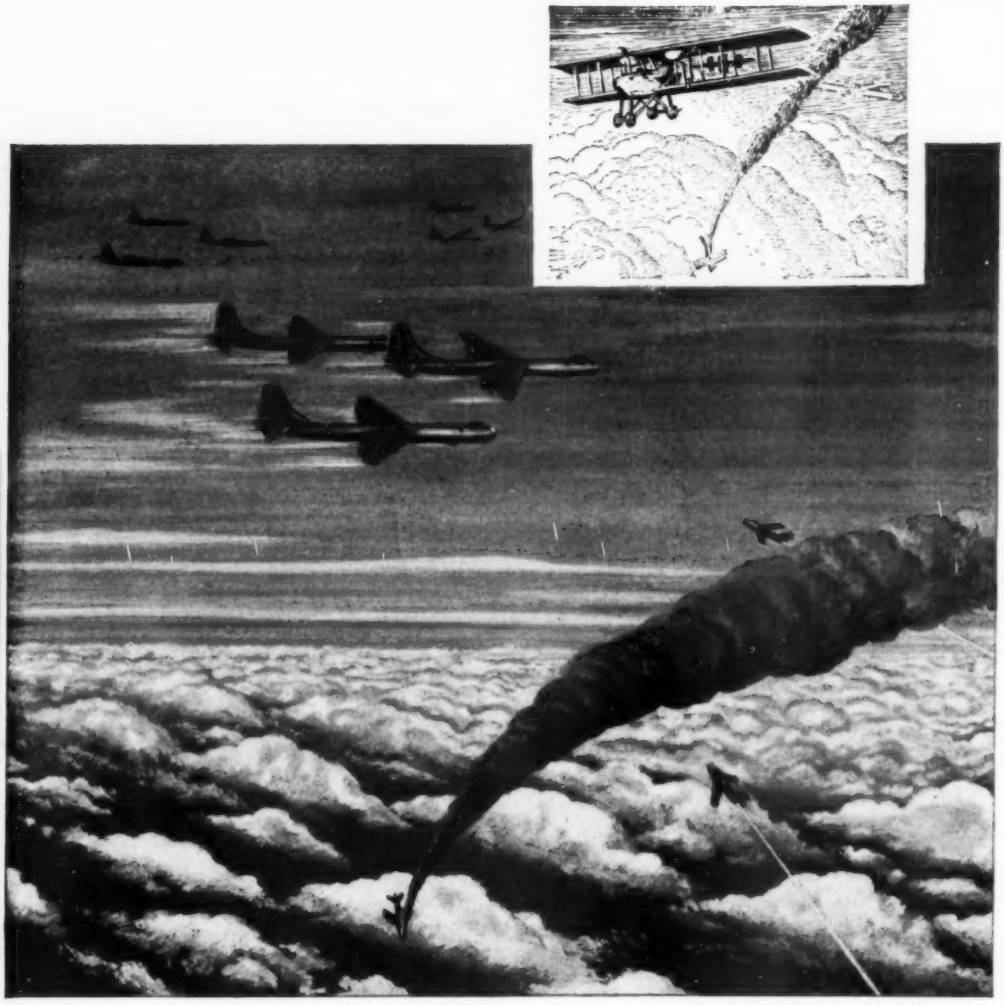
MOVING EARTH
short distances in a hurry —one of many jobs the "Cat" DW10, equipped with Bulldozer, can do. This rig's at work for the Isbell Construction Co., Ray, Arizona.

PULLING 3 ROLLERS
is all in a day's work for the 115-hp. "Cat" DW10 at Harlan County Dam, a U.S.A.E. project. In the background are 2 "Cat" No. 12 Motor Graders. Contractor: Harlan Construction Co., Nebraska.



PULLING SPRINKLER
to obtain the proper moisture content between fill layers—another chore for the versatile "Cat" DW10 on the Harlan County Dam.

BOOM-EQUIPPED
to lower heavy equipment quickly and easily — one of many uses that C. Ryan & Son, Lakewood, Colorado, make of their "Cat" DW10.

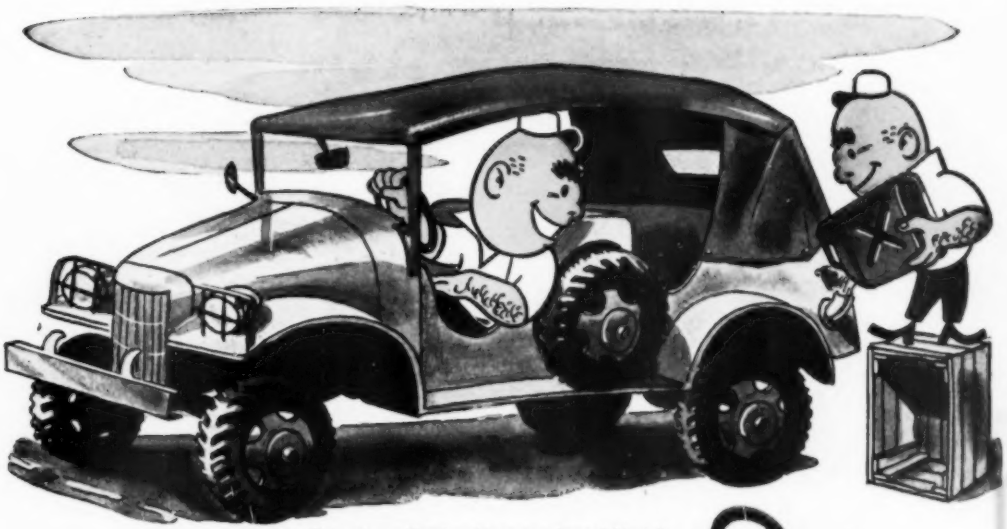


Today's speeds demand electronic gunnery

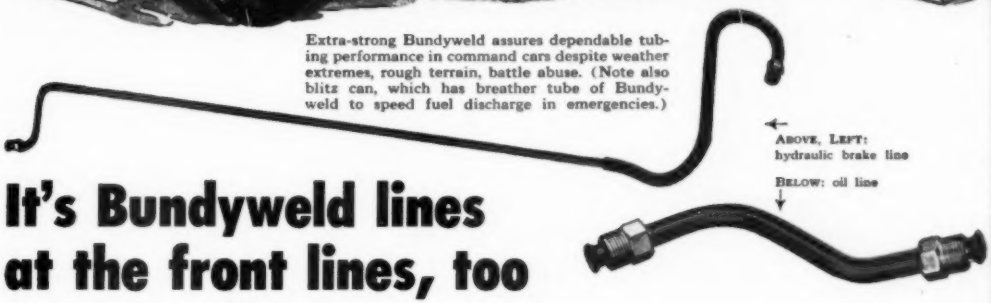
Today, with interceptors capable of closing in at blinding speeds, the problem of effective gunnery for bomber protection becomes increasingly acute. Split-second tracking, computation and firing are demanded – and complex, compact, light-weight electronic instruments furnish the answer. Arma – working closely with our Armed Forces since 1918 – has supplied the outstanding engineering, imaginative design and precision manufacture that play a leading part in producing these miraculous instruments.

ARMA CORPORATION
254 36th Street, Brooklyn 32, N. Y.
SUBSIDIARY OF AMERICAN BOSCH CORPORATION

QUALITY ARMA INSTRUMENT PRECISION



Extra-strong Bundyweld assures dependable tubing performance in command cars despite weather extremes, rough terrain, battle abuse. (Note also blitz can, which has breather tube of Bundyweld to speed fuel discharge in emergencies.)



ABOVE, LEFT: hydraulic brake line

BELOW: oil line

It's Bundyweld lines at the front lines, too

Top automotive tubing for twenty-five years, Bundyweld performs better in vital fuel, oil, brake, and hydraulic lines of army vehicles, too. Bundyweld takes more vibration, more pressure. It withstands the shock of jolts and jars. It won't leak.

Bundyweld fabricates better, too —comes to you scale-free, held to close tolerances, smooth and clean inside and out. It machines in almost any way, bends easily to short radii without weakening.

Bundyweld is the only tubing double-walled from a single strip, with a patented beveled seam-edge. It's copper-brazed through 360° of wall contact into a safer, stronger, solid-wall tube. For more information, or for help in solving bending problems, write today. ***Bundy Tubing Company, Detroit 14, Mich.***

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . . continuously rolled twice around laterally into a tube of uniform thickness, and passed through a furnace. Bonding metal fuses with basic metal, presto— Bundyweld . . . double-walled and brazed through 360° of wall contact.

NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.

Bundy Tubing Distributors and Representatives: *Cambridge 42, Mass.:* Austin-Hastings Co., Inc., 226 Binney St. • *Chattanooga 2, Tenn.:* Poirson-Deakins Co., 823-824 Chattanooga Bank Bldg. • *Chicago 32, Ill.:* Lapham-Hickey Co., 3333 W. 47th Place • *Elizabeth, New Jersey:* A. B. Murray Co., Inc., Post Office Box 476 • *Philadelphia 3, Penn.:* Rutan & Co., 1717 Sansom St. • *San Francisco 10, Calif.:* Pacific Metals Co., Ltd., 3100 19th St. • *Seattle 4, Wash.:* Eagle Metals Co., 4755 First Ave. South *Toronto 5, Ontario, Canada:* Alloy Metal Sales, Ltd., 881 Bay St. • **Bundyweld nickel and Monel tubing is sold by distributors of nickel and nickel alloys in principal cities.**

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☆ ***Die Cast Aluminum Jackets***
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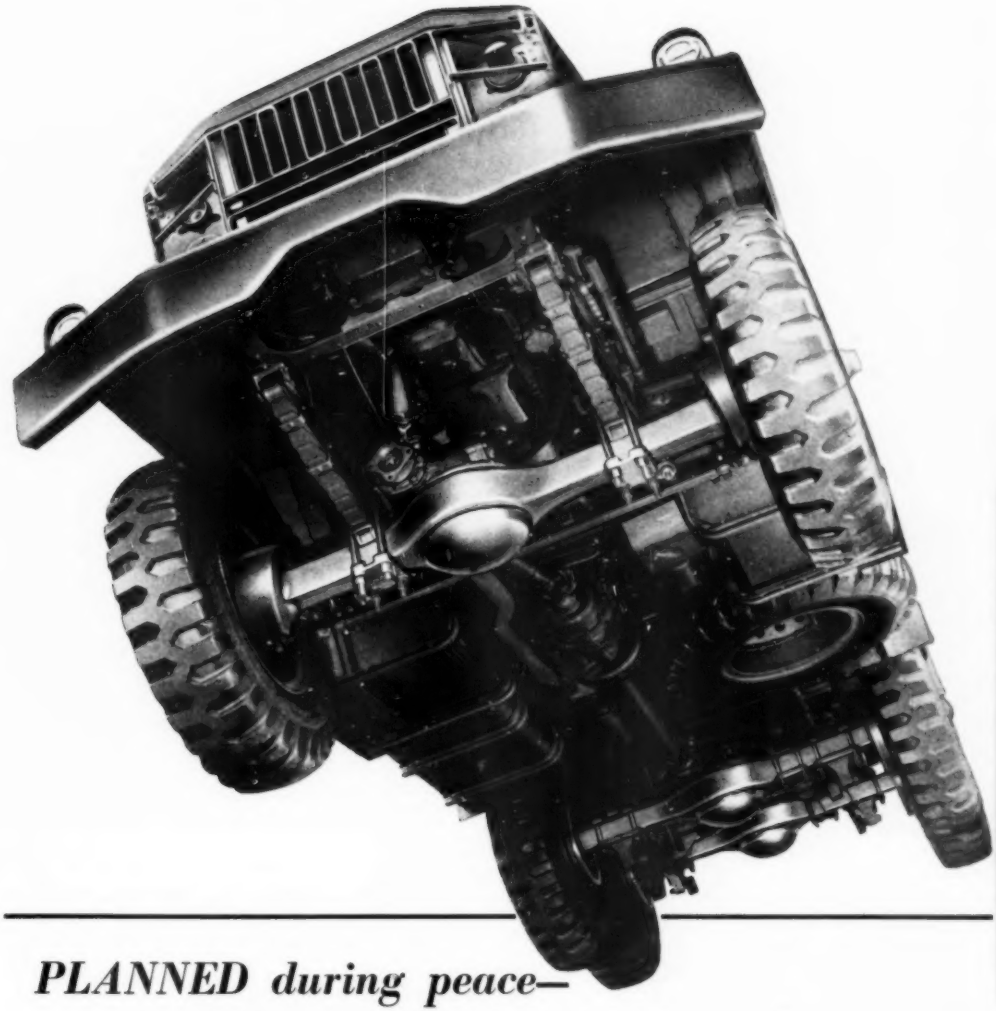
Complete assemblies with Permendur, steel or aluminum bases, inserts and keepers as specified. Magnetized and stabilized as required.

THE ARNOLD ENGINEERING COMPANY
SUBSIDIARY OF ALLEGHENY LUDLUM STEEL CORPORATION
General Office & Plant: Marengo, Illinois



PLANNED during peace—

PRODUCED for defense!

Defense work at The Timken-Detroit Axle Company is in high gear—thanks to a thirty-year program of continuous research, development and production! Working in close cooperation with Armed Forces personnel since World War I, The Timken-Detroit Axle Company has never relaxed its efforts toward more efficient front and rear axles, brakes, transfer cases and running gear parts for military motor trucks.

These vital truck parts have, in fact, been carried to their highest degree of development through this peacetime preparedness program. Among the most significant advances are vastly improved design, and the highest degree of parts standardization and interchangeability within each truck class yet achieved.

But the most important result of all is the fact that today The Timken-Detroit Axle Company is not discussing and planning defense work—*it's producing!*

TIMKEN Detroit AXLES

A PRODUCT OF THE TIMKEN-DETROIT AXLE COMPANY
DETROIT 32, MICHIGAN

Accepted D A Standard
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PLANTS AT: DETROIT AND JACKSON, MICH. • OSHKOSH, WIS. • UTICA, N. Y. • ASHTABULA, KENTON AND NEWARK, OHIO • NEW CASTLE, PA.

IN THE FRIGID ARCTIC... ...ON THE HOT DESERT SANDS

ANSUL ALL-TEMPERATURE FIRE EXTINGUISHING EQUIPMENT IS YOUR *BEST* PROTECTION

FOR FLAMMABLE LIQUID, GAS AND ELECTRICAL FIRES

Ansul Low Temperature Dry Chemical Fire Extinguishers, Models LT-4-A and LT-20-A, have been tested and approved for operation at 65° F. below zero. These same extinguishers will withstand prolonged exposure to temperatures ranging up to +160° F. They are recommended for use where extreme temperature conditions prevail . . . where other types of fire extinguishers may be inoperative or ineffective.

MODEL LT-4-A ABOVE, CENTER MODEL LT-20-A

Ansul Wheeled and Stationary Extinguishers can be provided with special hose to allow operation at temperatures lower than -40° F.

For flammable liquid fires, Ansul Dry Chemical Fire Extinguishers have the greatest fire-killing ratings ever attained by hand and wheeled portable fire extinguishers . . . Based on tests by nationally recognized approval agencies.

NOTE THESE IMPORTANT ANSUL FEATURES . . .

- Patented nozzle provides most effective stream pattern.
- Easy, on-the-spot recharging. (No tools needed.)
- Low maintenance costs — no annual recharge necessary.
- Water-tight, corrosion-resistant construction.
- Safe to use on electrical fires.
- ANSUL *"PLUS-FIFTY"*® Dry Chemical is non-toxic, non-abrasive, non-corrosive.

Get the facts. See comparative effectiveness ratings for various types of approved fire extinguishers. Write for File No. 694. You will receive complete information and other valuable data.

ANSUL CHEMICAL COMPANY
Fire Extinguisher Division
MARINETTE • WISCONSIN

DISTRIBUTORS IN ALL PRINCIPAL CITIES IN THE U. S. A., CANADA AND OTHER COUNTRIES

ATOMIC ENERGY

THE U.S. AND THE ATOM

Today the United States stands before the world with the lamp of liberty raised high in one hand and the atomic bomb in the other. To many people—both at home and abroad—this is a spectacle that is more fearsome than comforting.

It is not surprising that this is so, for the peoples of the world have seen the power of the atomic bomb demonstrated at Hiroshima and Nagasaki. They have seen the devastation that lay below the towering mushroom clouds, and they have no difficulty in imagining the suffering and desolation among innocent civilians that would follow in the wake of an all-out, global atomic war.

The Right Course?

So vivid is this picture that, even in the face of persistent Communist acquisitiveness and aggression, many sincere, thinking people have asked themselves the question: "Is the United States really pursuing the right course?"

I believe that we are. In essence, we have taken the position as a nation that war is bad, that aggression is bad, and that any weapon that serves to prevent war and aggression, or to stop aggression once it has been undertaken, is good. This is not an unreasonable position, particularly when one considers that to take any other position would in all likelihood mean the end, not only of our freedom and our way of life, but of all the noble ideals to which man has aspired through the ages.

I said that I believe we are following the right course. I would like to qualify this to the extent that I believe we are following the right course in so far as moral considerations influence the actions we take. Up to the present, in our period of atomic world leadership, we have undoubtedly taken the moral factor into account. We have been mindful of the heavy responsibilities that go with our position, and we have handled ourselves accordingly.

Our Embarrassment

For evidence of this, I think one need look no further than the obvious embarrassment we experienced when, at the conclusion of World War II, we found ourselves to be the only nation in the world with the atomic bomb.

I think it will forever redound to our credit that our awareness of the moral ramifications of exclusive possession of such a powerful new weapon resulted in

SERVING INDUSTRY THROUGH HYDRAULICS

SECRET WEAPON

FOR AMERICA'S VITAL AIRCRAFT INDUSTRY

Yes, here's a secret weapon that everyone knows about—America's superior production and manufacturing "know-how". Behind every shiny jet-propelled fighter, or massive high-speed bomber there's countless machine tools that have fabricated every inch of the streamlined fuselage and knife-edged wings. One of the production machines that "flies high" in the aircraft industry is the H-P-M Fastraverse press. Thirty-seven of these "all-hydraulic" H-P-M giants, ranging from 2000 to 7000 tons, have been built for the aircraft industry . . . four more (three 7000 ton and one 5000 ton) are now under construction. In addition to these large capacity presses, countless other type H-P-Ms are turning out a great variety of parts for both airframe and aircraft engine manufacturers.

Regardless of your metal working problem, there's an H-P-M to handle the job. H-P-M presses are completely self-contained, all-hydraulic – quick to set up, simple to operate, and low on upkeep. Write today for complete information on a specific application of H-P-M presses.

Bulletin 5005 describes H-P-M Metal Working Presses. Write today for your free copy.

HPM

THE HYDRAULIC PRESS MFG. COMPANY

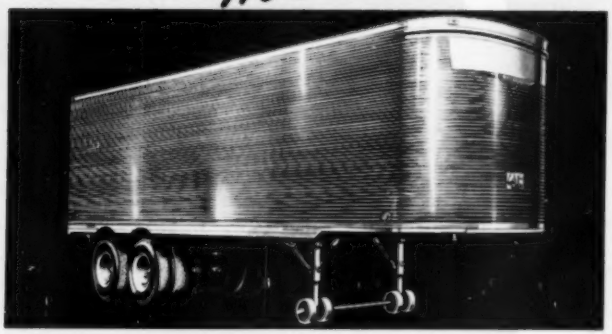
1090 MARION RD., MT. GILEAD, OHIO, U.S.A.

Makers of Presses for the Metal Working and Processing Industries - Plastics Molding Presses - Die Casting Machines - Hydraulic Pumps, Valves and Power Units.

O & S BEARINGS
NON-METALLIC • SELF LUBRICATING

. . . . . are Typical of the Original Equipment that Makes

FRUEHAUF *GREAT from the Ground Up!*



To many the two O & S Bearings shown here will appear relatively unimportant in so huge a thing as a trailer. To Fruehauf engineers — these bearings, as every other part or piece of material, are tremendously important. That's why Fruehauf is "great from the ground up."

O & S bearings are produced by a company with 38 years of manufacturing skill and engineering experience. O & S non-metallic, self lubricating bearings are designed for a definite job . . . built to do that job — better — longer and more economically.

WRITE TODAY FOR BULLETIN 251
OR SEND PRINTS AND DETAILS

Our 38th Year Manufacturing Original Equipment

NeverOil SINCE 1913

O & S BEARING CO.

303 SOUTH LIVERNOIS • DETROIT 17, MICHIGAN

Atomic Energy

our unprecedented offer to place the facilities for its manufacture under international control—an offer that, as you know, was subsequently turned down by the Communists, who meanwhile were busy developing a bomb of their own.

Our Restraint

I think it is also pertinent to note that during the postwar period when we had exclusive possession of the atomic bomb we never once resorted to its use to settle our international differences, even in the face of great provocation.

Unfortunately, I believe, the Communists have been aware of the important rôle played by the moral factor in our deliberations and they have counted on it and taken advantage of it in such instances as the Czechoslovakian *coup d'etat*, the North Korean aggression, the Chinese revolution, the Berlin blockade, and their flagrant violations of the Balkan peace treaties. We have quite obviously been reluctant to unleash upon the world the horrors of atomic warfare as the world has visualized it, and the Communists have consequently been granted a freedom of action they otherwise would have been denied.

In the meantime they have also been left free to pursue an atomic-weapons program of their own, a program which they may hope will someday cancel out this weapon as a means of warfare and thus permit them to utilize their great manpower superiority and the advantages of their strategic location in carrying out their master plan to achieve world domination.

But, in the long run, I am convinced our policies will be proved to have been right for, in pursuing them, we have gained in moral strength, while the Communist leaders are being revealed to the world as the predatory conspirators they really are. . . .

Past Concept

In the past, most of us have thought of atomic warfare in terms of intercontinental bombers striking at the great cities and industrial hearts of an enemy nation, and we have been appalled by the enormity of the destruction that would be wrought.

We have thought of atomic warfare in these terms because that is the way we saw it demonstrated—in capsule form—at Hiroshima and Nagasaki, and because we have considered the atomic bomb to be so rare and expensive and devastating that it could not be used on any but the largest and most profitable strategic targets.

This concept of atomic warfare, while still true, is now no longer the whole truth. It is but one kind of atomic war-

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Where the transporting of 2000 lbs. on 24" load centers is a prime requirement, the installation of the additional optional counterweight to the standard 20 model achieves the necessary result.

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The Hyster 20 for 1300 lbs. at 15" load centers or 1000 lbs. at 24" load centers has a skeleton counterweight that reduces the weight of the standard Model 20 by 600 lbs. This light weight but heavy duty fork lift truck will cut maintenance and operating costs; yet it will provide the maximum lifting and transporting capacities required in a great many industries.

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Atomic Energy

fare, and there is now a new, quite different kind, much less fearsome as far as noncombatants are concerned and much more promising as a means of halting aggressors without the risk of destroying large parts of the world in the process.

Weapons Plentiful

Because of our great technological strides we are now entering an era when the quantities of atomic weapons available to us will be so great, and the types so varied, that we may utilize them in many different ways heretofore not possible. This means that we are gaining the capacity to meet a given situation with an atomic weapon tailored to meet that situation. It means—in the language of the military man—an era when we can use atomic weapons tactically as well as strategically.

In the past, we in America have been inclined to attach an unusual significance to numbers as far as atomic weapons are concerned. Although the number of bombs we have has been an extremely closely held secret, and still is, there has been what amounts to a preoccupation on the part of many people to speculate on this number and to attempt to deduce it from the small bits and pieces of information that have been made public.

This number, I believe, has held such an unusual significance to these people because they have felt that it is relatively small, and they have attempted to guess whether it is greater or smaller than the number of potential targets atomic bombs might logically be used against. . . .

Message of Hope

I think our recent technological advancements constitute a message, not of despair, but of hope—hope to the millions of people throughout the world who have feared that the only two alternatives left to mankind are gradual submission to persistent Communist encroachment on the one hand or atomic obliteration on the other.

We now have the third possibility of being able to bring to bear on the aggressor himself—at the place of his aggression—the fruits of our technological capabilities and to meet the invading force in the field with a firepower that should cancel out any numerical advantage he might enjoy.

Not only does this provide hope that we can stop aggression once it has started, but, in so far as those who might be contemplating aggression understand the full import of what I am trying to say, it provides a real hope for peace.—GORDON DEAN, *Chairman of the Atomic Energy Commission, before the University of Southern California.*

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Efficiency in Defense Production

Harry L. Erlicher Adds the Business Viewpoint

TO only a few of us is given the opportunity of celebrating a fiftieth anniversary of business associations in one company. When those years are filled with milestones of important contributions, it is indeed a rich record of achievement.

On October 6, 1950, some of the friends and associates of Harry L. Erlicher, General Electric Company vice-president, gave a fiftieth anniversary breakfast in his honor. While paying full tribute to his excellent business leadership, they cited him particularly for his "warm, human approach"; for his "spirit of fairness"; for the way in which his door "has always been open to those who sought advice and counsel."

Today, as Special Assistant to the Under Secretary of the Army, Mr. Erlicher is very definitely putting the business viewpoint into the mammoth arms-production program. This viewpoint stresses a high degree of professional competence, economy mindedness, and an expert knowledge of human relations. Mr. Erlicher possesses all three qualities in an eminent degree.

Encyclopedic Knowledge

No man in industry today has a better knowledge of the source and availability of virtually every type of raw material than Harry Erlicher. He possesses an encyclopedic knowledge of industrial processes from the drawing board, through production and transportation, to the retail counter.

Purchasing is not only a highly complicated science but a key factor in the success of any business enterprise. If the quantity, quality, cost, and delivery schedules on raw materials or parts are not handled by a man who knows his specialty thoroughly, a company will be unable to compete successfully with other firms in the same field. The survival, growth, and splendid reputation enjoyed by General Electric during the present century is due in no small measure to the very able manner in which Harry Erlicher and his purchasing associates discharged their heavy responsibilities.

Mr. Erlicher is cost-conscious. His entire business experience has centered around the problem of manufacturing a better product at a lower cost to the public. Today, in supervising Army procurement, the American taxpayer can feel complete confidence in Mr. Erlicher's ability to obtain full value in defense equipment for the billions of dollars now being expended by the United States to safeguard some semblance of peace in the world.

The Human Side

In addition to his keen professional competence and his expert care of the taxpayer's money, Harry Erlicher has a profound understanding of human nature. Production is not a push-button affair; it is the result of human skill and ingenuity. Mr. Erlicher has had business dealings with more than thirty thousand suppliers.

This vast acquaintanceship in the whole industrial field is of tremendous importance to the Army procurement and production programs. Industrialists with major jobs to do for the Army who feel blocked, puzzled, or aggravated simply call Harry Erlicher and almost always the problem is solved.

His comprehensive knowledge of the human element in industry is of benefit to the Army not only because of the industrialists who are still with industry but also because of those who have made sacrifices, as he has done, to serve the Government in other agencies.

Speaking recently of the Army, Mr. Erlicher had this to say: "I have never seen a group more able nor more intensely conscious of their responsibility for the country's welfare. By their very attitude toward outsiders like myself, they court coöperation. The job they are doing, especially in the current emergency, is really fantastic."

A great team—Harry Erlicher and the U. S. Army. The taxpayer, in this regard anyway, can take hope.

Harry L. Erlicher, Special Assistant to Under Secretary of the Army, whose photograph appears on the front cover of this issue, was born in Schenectady, N. Y., in 1886 and began his outstanding career with the General Electric Company as a messenger boy when he was fourteen years of age. Becoming interested in purchasing, he requested a transfer to that department and soon became a clerk. Thus he became associated with the activity that was to make him a nationally known figure.

Mr. Erlicher moved through a series of positions, each a little bigger and more heavily loaded with responsibility than the preceding one. In 1910 he was a buyer. Thirteen years later he was assistant purchasing agent, and in 1931 general purchasing agent. The GE board of directors elected Mr. Erlicher a vice-president in 1940. At that time he had been with the company forty years and had attained the position of chief of purchasing and traffic.

His department served the entire company and worked with more than 33,000 suppliers of every type of raw material for the company's more than 200,000 different catalogued items.

Mr. Erlicher is in charge of Army procurement and production expediting in the Office of the Under Secretary. A part-time consultant on procurement matters to the Under Secretary last year, he assumed his new position as Special Assistant to the Under Secretary on July 1, 1951.

POINTED REMINDER *that the U.S. is well advanced on its rocket-warfare program is this 48-foot Martin Viking missile which reached a speed of 4,100 miles an hour and an altitude of 135 miles.*

Novel French Aircraft

Dewavement photo

Radical Designs May Forecast Future Trends

William Green

ALTHOUGH the hiatus of the war years has left the French airplane industry far behind the accelerated progress in aircraft development that has taken place in the U.S.A. during the past decade, it has not materially affected the characteristic love of novelty and traditional ingenuity of the French airplane designer.

Commonplace Tomorrow

There is a French saying that what is unusual today is the commonplace of tomorrow. This is certainly applicable to French aviation for, possessing the courage of their convictions, French airplane designers have certainly produced some unusual machines during the past year or so.

On seeing these novelties, we are reminded of the little boy who, upon seeing a giraffe for the first time, said, "There ain't no such animal." Yet we must admit that they fly, and their features may well have a marked effect on aviation tomorrow.

Only a short while ago one of Reuter's less well informed correspondents came up with the startling announcement that an "ornithopter" had been flown successfully in France. While nature remains the only successful designer of ornithopters, the machine that the misguided reporter referred to as an ornithopter was, nevertheless, quite startling, having rubber-mounted wings which can flap up and down in turbulent air. There is nothing intrinsically unsound in the idea, and it certainly appears to fulfill its purpose of reducing airframe stresses under gust conditions.

Known as the Rey 1-01 (Fig. 2) and designed by the Société des Avions François Rey, the machine has been built to test a new type of automatic variable-wing incidence. The outer wings are articulated on an oblique hinge line—roughly thirty-five degrees to the chordal plane—so that an upward movement of the wing decreases the angle of attack and, conversely, a downward movement increases the angle, automatically limiting the loads imposed.

The maintenance of the movable wings in a position of equilibrium is assured by an elastic linkage, the deformation of which under load permits the rotation of the wings about their axes. Over fifty flights have been made with the articulated wing and Monsieur Rey claims that it reduces stresses by sixty per cent when the airplane is flying in turbulent air.

Research Aircraft

A second research machine, the Rey 02, has been built for comparative tests, and plans are in hand to replace the present 220-horsepower Renault piston engines by small Turbomeca Piméné turbojets of 220-240 pounds' thrust each.

From flapping wings it is not a long stretch of the imagination to retractable

Mr. Green is a well-known British aviation authority and aëronautical journalist. At present, he serves as European correspondent to *Canadian Aviation*.

wings. And why not? Fixed wings are, at the best, a poor sort of compromise; the wing most suitable for the slowest landing speed and the steepest path of approach is far removed from that desirable for really fast flying.

Liberal "slottery and flappery" is the usual solution to the problems of increasing the low-speed lift of high-speed airplanes, reducing lengthy take-offs and slowing down landings.

Different Approach

A different approach to the problem was made, however, in France back in the 'thirties by Ivan Makhonine who conceived the idea of building a monoplane with telescopic wings—the outer sections telescoping into the inner sections to reduce wing area after take-off and increase it again for landing.

Makhonine's first research machine, a two-seater weighing more than 11,000 pounds and powered by a 950-horsepower Gnôme-Rhône engine, proved the scheme practicable, but the war interfered with flight testing, and the extreme interest in the idea evinced by the Germans resulted in Makhonine's decision to destroy his own airplane in order to prevent its removal to a Luftwaffe test center.

After the war, Makhonine started work on a second research airplane, the MAK-123. Powered by a 1,800-horsepower B.M.W. 801 radial and carrying a crew of four, with the outer wing sections extended the MAK-123 has a lifting surface and wing loading of 387.5 square feet and 56.3 pounds per square foot, respectively. With the outer sections retracted, wing area is 215 square feet, and wing loading is 102.4 pounds per square foot.

The wing is built in three sections: the center section is of great strength and built on two massive spars; the two outer sections slide within the center section, rollers transmitting the loads to the spars. The outer wing sections are readily extended or retracted by means of a quarter-horsepower motor.

On the first test hop with the new craft, Makhonine climbed to 13,000 feet, put the nose down, cut the engine, extended the outer wing sections, and succeeded in gliding the heavy airplane for *over one hour*. In flight there are no marked eccentricities of behavior when the wings are extended or retracted; the effect of retracting the wings is solely an increase in engine revolutions as a result of the reduced drag, and when the wings are opened the plane automatically climbs owing to the increase in lift.

Unfortunately, a forced landing after an engine failure caused extensive damage to the MAK-123, but reconstruction is now complete and flight trials will shortly be resumed.

High Aspect Ratio

There is nothing new in a very high aspect ratio wing; examples can be seen on any high-performance sailplane. Any sailplane pilot will tell you that a high aspect ratio wing reduces sinking speed. At moderate speeds for a given wing area, the higher the aspect ratio the greater the lift and the less the drag.

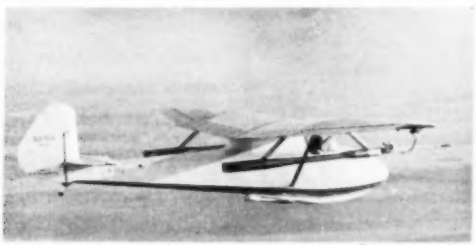
Maurice Hurel, while he does not profess that the idea in itself is original, has produced an experimental airplane fitted with what is likely to become the "new look" in wing design for freighter airplanes and feeder liners; namely, a very high aspect ratio wing. What is more, he has succeeded in convincing the French authorities of the potentialities of this type of wing and has received an order for two examples of a military freighter embodying this feature.

Claims Confirmed

Hurel's first experimental airplane, the Hurel-Dubois HD-10 (Fig. 8), gave startling results when tested at the Centre d'Essais en Vol (Government Flight Test Center) at Bretigny-sur-Orge, more than confirming its designer's remarkable claims. Featuring a 39½-foot wing span with the aspect ratio of 32.5—probably the highest aspect ratio wing ever flown—the HD-10 succeeds in overcoming the serious structural disadvantages associated with this form of wing (the higher the aspect ratio the smaller are the wing spars to carry the large bending loads) by bracing the wings at mid-span.

Wind-tunnel tests have proved that the induced drag of a monoplane braced by suitably designed lifting struts is no greater than that of a cantilever monoplane of the same span and lifting surface. The use of these struts permits the doubling, or even trebling, of the aspect ratio without increasing the weight of the wing.

In its initial form the HD-10 was powered by a 40-horsepower Mathis G.2 F. motor and, because of the sailplane like sinking speed (Monsieur Hurel told the writer that it is 4.1 feet a second with engine cut and flaps down) the machine can cruise with the engine "ticking over" at 16 horsepower.



Dengremont photo

Fig. 1. The four pulsejets propelling the Emouchet glider, above, resemble the power plants of German "buzz bombs."

Dengremont photo

Fig. 2. The Rey 1-01 research plane, above, possesses a hinged wing for automatic variation of wing incidence.

Fuel consumption is amazingly low, being 62 miles per gallon when cruising at 110 miles an hour. The wing area of the HD-10 is only 48.3 square feet, the power loading is 31 pounds per horsepower, and the wing loading is 24.5 pounds per square foot.

Motor Replaced

In order to exploit the full potentialities of the wing, the Mathis motor has now been replaced by the more powerful 75-horsepower Praga D which increases maximum speed to 158.5 miles an hour.

Data acquired from tests with the HD-10 have been applied to the HD-31 military freighter (Fig. 3) in the DC-3 category, two examples of which are at present under construction. This airplane will have a wing aspect ratio of 20.5 and will be powered by two 800-horsepower Wright C-7BA radials.

It is estimated that the operating costs of the HD-31 will be only forty-five per cent of the costs of a conventional airplane of similar capacity, and between thirty-five and forty per cent of the total weight of the transport will be useful load—approximately twice that of a conventional aircraft.

A Different Biplane

An interesting, if complex, attempt to provide maximum safety but at no expense to economy and high performance is the Millet-Lagarde ML-10 (Fig. 7) in which the designer, Jacques Lagarde, has reverted to the old formula of the tandem-wing cantilever biplane—but with a difference.

Apart from its unusual control features, one of the novelties of the ML-10 is a fixed-pitch slotted airscrew which is claimed to decrease take-off run and increase cruising speed as compared with a normal variable-pitch airscrew. A slot effect is also obtained in the wing configuration—the flat upper wing's trailing edge being directly above the leading edge of the lower wing which features very marked dihedral.

The control system is unique in dispensing with rudders and rudder pedals. The elevator is restricted in travel and is coupled with large automatic flaps which stretch over seventy per cent of the upper wing trailing edge, automatically increasing or decreasing the "slot" effect of the wings. Longitudinal stability over a wide range of angles of attack is insured. Directional control is obtained from wingtip spoilers which open in response to lateral movements of the control wheel.

Monsieur Lagarde claims that the ML-10 cannot be stalled and that the wings maintain lift up to an incidence of thirty-two degrees. Directional stability remains up to the same angle and lateral stability up to thirty degrees. With four persons, the ML-10 has a landing speed of 40-45 miles an hour,

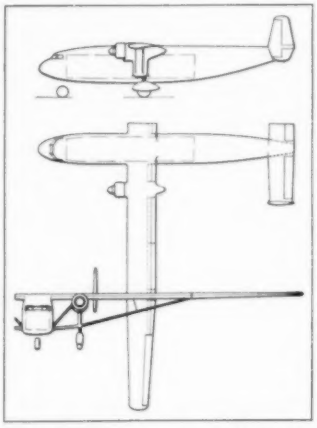


Fig. 3. Scale drawings of the Hurel-Dubois military freighter now being built.

a landing run of little more than 50 yards, a take-off run of 130 yards, a rate of climb of 787 feet a minute, and a top speed of 146 m.p.h. The engine used is a 178-horsepower Regnier.

In the design of small jet units and in novel uses for jets the French are undoubtedly way ahead of the U.S.A. Certainly the most important step forward in personal flying for two decades has been made possible by the development in France of an extensive series of miniature straight jets, propjets, and pulsejets which now power a wide variety of engaging little personal airplanes, the like of which have yet to be seen outside France.

If one is both an ultralight-airplane fan and stone deaf, or can sufficiently disregard one's aural sense to enjoy a horrific roar, one will certainly be taken by the Emouchet-Escopette (Fig. 1) powered by a battery of miniature pulsejets. In actual fact the machine is a standard Emouchet glider fitted with either four or six tiny Pulso Type 3340 Escopette resonance pulsejets, similar in principle to the power plants of the old German "buzz bombs."

Produced by S.N.E.C.M.A. (Société Nationale d'Etude et de Construction de Moteurs d'Aviation) and resembling an organ pipe with a peculiar "walking-stick" curve at the front end, the Escopette jet engine is a simple metal tube 9½ feet in length, 6 inches in diameter, and weighing only 10 pounds. It has no moving parts, and fuel is fed into the tube and ignited by means of a small sparkplug. Thrust and specific consumption vary with the fuel delivery pressure, but rated thrust is 22.046 pounds at which fuel consumption is 1.8 lbs./hr./lb.

Much of the duct behind the combustion chamber operates at red heat, but thermogauges installed in the Emouchet's wing have proved that the temperatures reached by the pulsejets do not present any danger. Nevertheless, a special fireproof paint coating is applied to the wing under surfaces.

The Escopette certainly provides an inexpensive means of propulsion and, if one can ignore the ear-shattering noise it emits, it succeeds quite well in its purpose of pushing the Emouchet through the air with alacrity.

Small Turbojets

In the very-small-turbine field the Turbomeca concern of Bordes has a whole range of unique little units giving thrusts ranging from 200 to 840 pounds. The company's 220-240-pound-thrust Piméné turbojet is already becoming well known in Europe, while later units—the 330-pound-thrust Palas and the Marboré I and II of 660 pounds' and 840 pounds' thrust respectively—have each successfully completed some hundreds of running hours.

Sharing their basic design features but having secondary by-passed airflow is the 485-pound-thrust Aspin I and, related again, are the two small turboprops, the 160-horsepower Oredon and

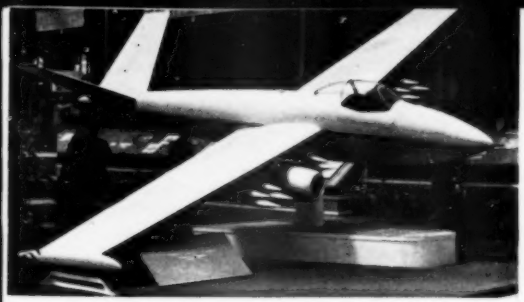


Fig. 4. The Fouga CM-82-R Lutin, twin-jet racing monoplane and model of the proposed CM-821-R military trainer. The Lutin has a maximum speed of 310 m.p.h. Jet pods are detachable.

Fig. 5. The Fouga Cyclope II is a fully aerobatic jet trainer powered by a single Palas turbojet giving 353 pounds' thrust. It is 22 feet long with a 29-foot span and a total weight of 1,371 pounds. Maximum speed is 217 m.p.h.

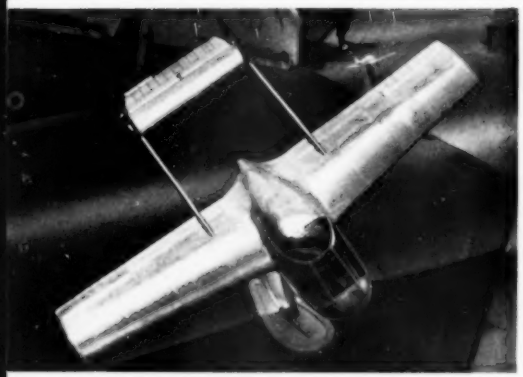


Fig. 6. The SIPA-200 light twin-boom "primary" trainer and liaison monoplane now under test by the French Government. Powered by a single Turbomeca Palas jet of 352 pounds' thrust, the S-200 cruises at 240 m.p.h.; range is 400 miles.

Fig. 7. The Millet-Lagarde ML-10 tandem-wing biplane powered by a 178-h.p. Regnier engine, lands at 40 m.p.h. and has a maximum speed of 146 m.p.h.

Fig. 8. Shown in its latest form is the Hurel-Dubois HD-10 ultra high aspect ratio wing research airplane. Powered by a 75-h.p. Praga D engine, the HD-10 has a 39-foot, 4-inch span, a wing chord of 15.75 inches, and a length of 16 feet, 10 inches.

275-horsepower Artouste. A manufacturing license for the Oredon was recently acquired by the Fairchild Engine & Airplane Corporation, Farmingdale, N. Y.

Examples of these miniature jets are flying in a variety of light airplanes produced by the Fouga concern of Air-sur-l'Adour, the first of which was the Fouga Sylph powered by a 264-pound-thrust Piméné. Developed from the C.M.8 sailplane, the Sylph was originally intended for weather observation and research.

Further development led to the Cyclope II (Fig. 5) aërobatic monoplane powered by a 352-pound-thrust Palas and a series of 2-seat, twin-fuselage research machines and touring airplanes named Gemeaux.

The Gemeaux Airplanes

The Gemeaux I, pictured on page 394, is powered by two Piménés, the experimental Gemeaux II by a 660-pound-thrust Marboré I, and the experimental Gemeaux III by an 880-pound-thrust Marboré II. Later versions of the Gemeaux will be used for testing the Aspin, which has a thrust of 485 pounds.

Needless to say, the French authorities were quick to realize the suitability of this new range of light turbines for installation in fast military liaison airplanes and jet trainers, and two examples of the SIPA-200 (Fig. 6) side-by-side two-seater, powered by a single 352-pound-thrust Palas unit installed in the rear of the fuselage nacelle, are being readied for flight testing in the near future.

French Ingenuity

French aviation has always been prolific in new ideas and inventions, and novelties and gadgetry remain a characteristic feature of French aviation development. Although we may have reason for concern at the present time at the unsubstantial contribution that France's aircraft industry is making toward Western air defense, we can rest assured that when French assembly lines *are* again active the aircraft that they carry will show much of the ingenuity that is to be seen on a smaller scale in French skies today.

We Need Engineers

A Strategic Resource Is in Very Short Supply

by

Dr. S. C. Hollister

Our power must lie not in numbers of men but in our technical strength measured all the way from the research laboratory to the firing line

MODERN warfare puts a premium on brains. In Washington's time the tools of warfare consisted of the musket—which most men learned to use to provide meat for the family—and the simple muzzle-loading cannon. I can remember in my boyhood the sham battles the National Guard "fought" with similar weapons. The tactics to be mastered were simple. The manning of weapons was easy because the required skills for their operation were relatively generally available.

Weapons Have Changed

Beginning with World War I, technology has greatly changed the nature of weapons. With each advance there has come a need for more specialized training for operation, more skilled technicians for maintenance, more elaborate engineering preparation and equipment for production, more technical knowledge in engineering and science for design and development.

During the Second World War it became clear that after the battles were joined and the enemy's strength of firepower measured, the success of the campaign hinged frequently in revision of matériel and in the design, manufacture, and launching of new weapons, many of a highly technical character.

Indeed the waging of wars has become a battle of scientific ingenuity between the technical personnel of the opposing countries, extending from the battle front all the way back to the designer and researcher.

Sheer numbers of men in the field

are not enough. In fact, we know that we do not have available the numbers that our enemy can mount. Our power lies in our technical strength measured all the way from the research laboratory to the firing line. We are relying upon our ability to create weapons and tactics superior in effectiveness to those of our enemy. In short, we are placing our faith upon what our scientists and engineers can design, develop, produce, and operate.

It seems obvious that there is not an unlimited supply of persons capable of manning, after suitable training, the many highly specialized implements of our fighting forces. Such persons are drawn from the same source that must man our factories and our transport and that must staff our research and design organizations where the new ideas must be born. The leaders of all such groups, whether in the field, the factory, or the laboratory, are the engineers and scientists. They are indispensable in all these categories. They are in critically short supply.

Dr. Hollister is dean of the College of Engineering, Cornell University, Ithaca, N.Y. This is the first of two articles analyzing our critical need for trained technicians. The second article, by R. E. Gillmor, vice-president of the Sperry Corporation, will appear in the next issue.

Increasing Need

The Bureau of Labor Statistics in 1949 undertook to appraise the need for engineers in a strictly civilian economy. They based their estimates upon prewar figures. It was their conclusion that during the decade 1950-1960 the need for engineers would increase from 18,000 to 22,000 graduates annually. It should be remembered that this estimate was based on prewar trends. It did not allow for the flow of engineering graduates into nontechnical occupations, and it was made a year and a half before the beginning of the Korean "police action."

At the time, the colleges were graduating those classes that represented the greatest bulge in the postwar GI program—31,000 in 1948, 47,000 in 1949, and 51,000 in 1950. Word got around that engineers were in oversupply, and high-school counselors advised many boys to go into fields other than engineering.

Unfortunately, two things were overlooked at that time. The first was that the large graduating class was just a bulge caused by the interruption of education during the war and the consequent sudden return in large numbers of veterans under the GI Bill.

Trend Forecast

The second was that most persons had forgotten that the trend of the size in graduating classes in future years could be foretold with some accuracy by noting what was happening to the size of the freshman classes. In 1946 there were 91,000 freshmen; in 1947, 57,000; in 1948, 48,000; and in 1949, 37,000.

The situation of large classes was clearly temporary, due to the accumu-

lation of students in the immediate postwar years, and it was returning to normal prewar rates of graduation. Nevertheless, many boys were being advised not to enter the engineering profession because of what appeared to many as an oversupply.

The graduating class of the academic year 1949-1950 was to be the largest ever—51,000. As June approached, many feared there would be few jobs. The previous year a class of 47,000 had been absorbed. A survey as of June 15, 1950, made by the American Society for Engineering Education indicated a placement at that time of 65 per cent.

Normal Rate

This rate at that time of year is about what is expected in a normal year since it is customary for a part of the class to begin their jobs in the fall. It appeared to many who were following the manpower developments carefully that there would be no significant oversupply of engineering graduates. In fact, some were already pointing to a shortage just around the corner.

At this point, hostilities broke out suddenly in Korea. Since then, as is well known, the rapidly expanding need of industry and the armed forces for engineers has encountered a gradually dwindling supply.

For several years there will be felt a new factor in the situation which is just now beginning to affect the size of graduating classes. Students finishing in 1951 were born about 1930. During the depression years there was a marked reduction in birth rate. The graduating classes of the next ten years will be greatly reduced because of this consequence of the depression.

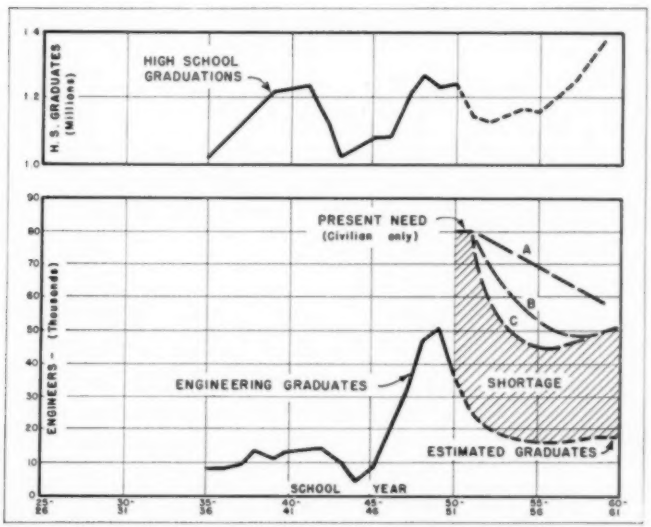
Increase in 1961

After 1961 there will be a marked increase due to the sharp rise in the birth rate during and since the war, which is now being felt in the lower grades of the public schools.

The accompanying chart, taken from one prepared by the writer for the American Society for Engineering Education, shows the numbers of engineering graduates from the academic year 1935-1936 to the present time. It also shows the estimated number of graduates up to 1960-1961. It should be noted that this latter part of the curve is known with fair accuracy to 1953-1954, since the students graduating up to that time are already enrolled in the engineering colleges.

Moreover, a recent survey of the anticipated freshman enrollment next fall indicates about the same number as enrolled last fall, thus bringing the estimates forward to 1954-1955 with good accuracy. If there is a change in Selective Service policy that will dip into the engineering enrollments, there will be correspondingly a reduction in the number of graduates indicated on the chart.

There are shown on the upper part of the diagram the actual and estimated high-school graduations as reported by the U. S. Office of Education. Of the total numbers shown, about half are males. Since the number of women taking engineering courses is insignificant, it is the male graduation forecast that produces the eventual outlook for engineers.



Number of engineering graduates from 1935-1936 to the present, together with estimated graduates up to 1961. Top section shows high-school graduations.

Enrollment Smaller

One factor that is revealed by a study of the high-school graduation and freshman engineering figures is the fact that before the Second World War about 5.8 per cent of the boys graduating from high school continued into an engineering college; whereas in the fall of 1950 (and as seems likely in 1951) only 4.8 per cent will choose this profession. The reasons for this are many and not clearly defined.

The Engineering Manpower Commission of Engineers Joint Council undertook early in June 1951 a survey of the immediate need of engineers in industry and in civilian capacities in Government agencies. Based upon 378 responses, it was estimated the civilian need in the country for engineers was about 80,000, before the hiring of June graduates.

The June class numbered only 38,000; and an earlier survey by the Manpower Commission disclosed that about 19,000, or half the class, had commitments to the military through the R.O.T.C. or other Reserve programs, or were liable to the draft. Unless considerable numbers are deferred, industry will still be short some 60,000 engineers.

Unknown Factor

Whether the numbers committed to the Reserves are adequate for the armed forces is not known. It is certain that many engineering graduates are in

R.O.T.C. units where their engineering training will not be fully used. In some cases such training will not be used at all. Few such graduates taken by the draft will reach spots where their training will be needed or used—at least such appears to be the experience of many drafted engineering graduates. Such misplacement of engineers is costly to the Nation when there is such a critical shortage. In the end it will delay the development and production of defense equipment.

The outlook for relief of the shortage from future graduating classes is not encouraging. From classes now in school it is estimated that the graduations will be 26,000 in 1952, 17,000 in 1953, 12,000 in 1954, and 12,000 in 1955. It does not now appear that the demand next June will be any less than at present. What the demand will be thereafter may possibly follow curves A, B, or C, dependent upon policies that may be adopted in the meantime by industry and Government, including Selective Service and the armed forces. At best, the prospective shortage is of critical national importance.

It is clear that between now and June 1955 very little can be done to increase the size of the classes that will be graduating. How, then, can there be at least partial alleviation of the situation? What policies would help remedy it?

Revise Use Pattern

The figures of need shown on the chart are based obviously upon the current pattern of utilization of the engineers in existing organizations. The most fruitful move that could be made by industry and Government would be a revision of this pattern of use. Industry is generally prone to move slowly in putting responsibility upon young men. In this respect the Army, Navy, and Air Force do a far better job in development of leaders by putting responsibility upon them early and by increasing the responsibility as rapidly as possible. It is amply demonstrated that men grow rapidly under such a procedure. In industry this would result in widening the effectiveness of each engineer so advanced.

As a companion move, it is essential that there be adequate supporting personnel in technician and junior engineering positions. These persons may be trained more easily than an engineer. Training programs should be instituted *at once* along the lines of those used during the last war.

Each year about 10,000 graduates are needed to replace those leaving the profession through death, retirement, or other separation. A short-time aid could be effected by delaying retirement where feasible.

Increase Responsibility

A complete review of the utilization of engineers in industrial organizations should be undertaken to the end that the contribution each could make be brought to the maximum level. Each one should be pushed to his capacity in responsibility. Those jobs that could be filled with fair effectiveness by other than engineers should be so filled.

Certain industries, such as the electronic or aëronautical, must supply their needs mostly from the ranks of young engineers. It is not easy to bring older engineers who have not specialized in these newer fields into them with good effectiveness. This, again, limits the supply; moreover, the same limited source is drawn upon for men by the armed forces.

The steps that governmental agencies can take with respect to the critical situation have already been initiated by the Civil Service Commission and the Defense Manpower Administration of the Labor Department. All agencies employing engineers and scientists have been called upon to reëxamine every case to the end that (1) engineers and scientists are not used in assignments that others might fill; and (2) that to a maximum degree these specialists are placed where they are most effective in the defense effort. It now rests with the agencies as to what can actually be done.

The task facing the armed forces is the most difficult of all, but none the less urgent. Policies must be formulated respecting Reservists, recruits, and draftees to make the greatest use of engineers and scientists, whether such use be within or outside the services. Industry must supply nearly all the weapons. Such supply hinges upon the availability of scientists and engineers, both categories in so short a supply as to be dangerous to our military preparedness.

Of all the major belligerents during the Second World War, ours was the only government adopting the policy of no continuity of training of engineers and scientists. Our present shortage of men with from five to ten years' experience is due to that mistaken policy.

According to the technical press, Russia has been turning out 30,000 engineers annually with training about equivalent to a master's degree here and in addition is graduating 70,000 a year from technical institutes. It is obvious that Russia recognizes the rôle of the engineer in national life, both peacetime and military. In the meantime we are producing about half as many as they over the next four years.

Integrate Training

Long-range planning involves, among other things, universal military training. I am in favor of, and have worked actively for, such a program. But I do not believe it will be effective as an adequate plan of preparedness, unless (1) there is within the program a means of integrating *both* civilian and military training; and (2) there is available to those responsible for our defense a manpower roster at least covering all essential specialized categories.

Such specialized personnel are not available at age 18 or 19. They cannot be trained in a few months. Yet they are indispensable in a modern military force. The problem of their wise use will always remain a major one, as it is today.

Shortage of specialized manpower, like strategic materials in short supply, requires the greatest possible conservation of the resource. At present it cannot be stock-piled. It may yet have to be rationed. Supply and demand will not affect it for a decade. What can be done must be done now.

Preparing static test of B-36 structure (USAF photo)

Wright Air Development Center

Powerhouse of Our Technological Air Superiority

by

Capt. H. S. Fisher, Jr.
Wright Air Development Center

The primary function of the Center is to translate military requirements into performance specifications

THE jigsaw puzzle of American air supremacy is being painstakingly fitted together in the laboratories of the Wright Air Development Center at Wright-Patterson Air Force Base, Dayton, Ohio.

An Expanding Monument

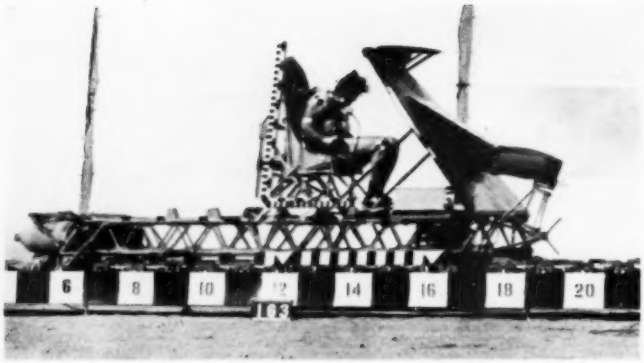
Located near the site where the Wright brothers sprouted their fragile wood-and-cloth wings nearly a half century ago is an orderly maze of runways, hangars, wind tunnels, whirl rigs, test stands, laboratories, and offices—an ever-expanding monument to man's vision of wings.

Here, through the efforts of the Wright Air Development Center, is carried out the research and development vital to achieving technological superiority in the air.

Wright Air Development Center is a brand-new infant this year, born of necessity when Air Force engineering outgrew its subordinate rôle within the Air Matériel Command. Now the research and development functions formerly assigned to the Research and Development Directorate of AMC in the Dayton, Ohio, area have been consolidated under WADC and brought under control of the newly established Air Research and Development Command. Maj. Gen. Fred. R. Dent, Jr., is the commanding general.

Primary Function

The primary function of the Wright Air Development Center is to translate military requirements into performance specifications. On the basis of these specifications, contracts are negotiated with industry for the development of specific items of equipment. During the



Human subject being sharply decelerated after a ride of 120 miles an hour on the special device used to simulate the effects of airplane crash impacts (USAF photo).

course of these contracts, Center engineers work closely with the contractors, testing and evaluating the items after completion. Similarly, contracts are negotiated with educational institutions for research.

The Center thus acts as an agency between science and industry on the one hand and the Tactical and Strategic Air Forces on the other.

Many "Firsts"

Personnel at WADC hold such "firsts" as the highest recorded parachute jump, parachute drops with automatic opening equipment, deceleration tests up to forty-five times the force of gravity, and many others. The laboratories here have also produced or monitored the production of such pioneer items as many types of aërial cameras and photographic techniques, flight instruments and systems, including fully automatic flights, all-weather flying, refueling in flight, electronic controls, electronic methods and "gadgets," pilotless aircraft, guided missiles, environmental and materials testing, basic and applied research studies, aëromedical advances, and armament improvements.

Various Divisions

Briefly, here is an outline of the various divisions of the Wright Air Development Center and what they do:

Weapons Systems Division.—Exploration of new flight frontiers in piloted aircraft and guided missiles challenges the engineers of this division. They monitor the complete experimental piloted aircraft program of the Air Force and conduct research in pilotless aircraft and guided missiles. Other responsibilities of the division include projects involving military application of atomic energy, special weapons development, radiological warfare, and the development of nuclear-powered aircraft.

Weapons Components Division.—Largest of the WADC divisions, Weapons Components provides electronics, photographic, firepower, and accessory equipment. Its six laboratories—aircraft radiation, armament, communication and navigation, components and systems, equipment, and photographic reconnaissance—cover a multitude of projects.

Aëronautics Division.—Aircraft and missile design and structure problems are studied three ways in the laboratories of this division. The aircraft, propeller, and power-plant laboratories institute research and development in transonic and supersonic flight, propeller and rotor performances at high speeds and altitudes, and conduct programs to effect the advancement of reciprocating, turbojet, turboprop, ramjet, and rocket engines for aircraft and guided missiles.

Research Division.—Three laboratories—flight research, materials, and aëromedical—in this division are responsible for providing basic and applied research studies in the physical and life sciences. For example, with technical advances in aëronautical engineering increasing the performance of aircraft, demands upon flying personnel have increased tremendously.

Aëromedical Laboratory

Aëromedical laboratory engineers therefore are called upon to study the effects of high speed and altitude on the human body and to develop equipment to improve the health and efficiency of air crews.

Materials laboratory engineers study new aircraft materials and develop techniques to protect equipment from environmental conditions. Flight research provides consultation and advisory research and supplies computation services for all activities of the Air Force.

Flight Test Division.—Pilots in this division fly all types of experimental and production-type aircraft to check performance, stability, and control characteristics and obtain information on the serviceability of equipment.

All-Weather Flight

The development and evaluation of all-weather flight systems and techniques associated with all-weather flying is a function of this division. Recently developed, for example, was a long-range, radar-controlled landing system that speeds up landing times and reduces "stacking" both for military and civilian aircraft.

Matériel Division.—An extensive supply service and matériel support system lies behind the development work of the Wright Air Development Center. The job of the matériel division is broad and diversified. Briefly, the division provides supply services, matériel support, air installations, field and depot maintenance, and many others.

Engineering Standards Section.—The control and coördination of engineering standards to insure maximum use of standard practices, materials, components, and parts in the design, production, and maintenance of Air Force aircraft and equipment is the responsibility of the all-important engineering standards section.

The effort of all WADC components is aimed at but one vital objective—our technological superiority in the air.

Improving Ordnance Management

New Program Stimulates Better Business Methods

by

Col. E. C. Bomar

The Chief of Ordnance has found it advisable to pin-point responsibility for the management functions within the Ordnance Corps by establishing a separate management office which reports directly to him

THE present international crisis, just as was the case in the Second World War, has ballooned the operations of the Army Ordnance Corps into one of the biggest businesses in the world.

Maintaining the flow of ordnance material from the development state through to the point of issue to our Army, our Air Force, our Marine Corps, and, in some measure, to our allies overseas, presents problems in management so complex as to stagger the imagination.

A Big Job

The job of Army Ordnance is, of course, not only to develop, but to manufacture or procure, store, issue, and maintain the infinite variety of weapons, ammunition, vehicles, and all related equipment for these armed forces.

Currently, it is about a thirty-five billion dollar operation. This figure includes the twenty-six billion dollars available to the Chief of Army Ordnance in funds on hand plus those contained in appropriation bills being considered by Congress. The remaining approximately nine billions of dollars represents the acquisition cost of current inventories of weapons, ammunition, equipment, and the hundreds of thousands of necessary spare parts in Army Ordnance depot warehouses.

Not included in the above are real estate, plants, and equipment with acquisition cost of about eight billions.

Compare these astronomical figures with those appearing on the balance sheets of large industrial enterprises. For example, the consolidated balance sheet of General Motors Corporation shows total assets of about 3½ billions, and almost one billion of this figure represents real estate, plants, and equipment. That will give you a rough idea.

From the Pentagon, the Chief of Ordnance administers and controls the operations of more than 100 field establishments—arsenals, depots, districts, and industrial plants—which employ an aggregate of approximately 160,000 persons at the present time. Actual operations are fully decentralized to the field, and the departmental overhead, in Washington, is the lowest of any of the technical services—slightly over one per cent of total Army Ordnance strength.

Managementwise, this problem of centralized control of decentralized operations is complicated by the explosive expansion which has taken place in the level of Ordnance activities during the past year. The Ordnance backlog of orders has increased about twenty-five times since Korea with an insistent demand for early deliveries.

Colonel Bomar is chief of the Management Office in the Office of the Chief of Ordnance, Washington, D. C.

Office Established

After the impact of the Korean incident, with Army Ordnance employment climbing at the rate of 2,500 new employees a week, the Chief of Ordnance found it advisable to pin-point responsibility for the management functions within the Ordnance Corps by establishing a separate management office which reports directly to him.

This should not be taken to imply that Ordnance has not been management-minded in the past. Our operations have always been patterned on what we believed to be the best practice in industry, and, in at least one instance, an Ordnance arsenal pioneered in the field of time studies. The so-called "Taylor System," which resulted from this work, was widely copied in industry.

Recent Change

However, there has not been, until recently, a central management office directly responsible to the Chief of Army Ordnance and charged with developing and supervising a coördinated, across-the-board management program.

The Management Office, in existence for less than a year, has recruited its present personnel by careful selection, both from within and without the Ordnance Corps. It is developing a management-improvement program in close coöperation with the agencies affected in each instance. The old saying, "You can lead a horse to water, but you can't make him drink," applies with particular force to our activity.

It is essential that every segment in the far-flung Army Ordnance organiza-

tion realize that an increase in effectiveness of its operations is feasible, and understand that this increase must be achieved by local effort. We in the central office can point out where the shortcomings exist and build the desire for improvement; we can suggest ways of doing the job; we can assist—but the job itself must be done by local effort.

The first requirement in any management-improvement program is to determine "where you are at." In other words, it is necessary to take stock to determine where improvement can be made and how much improvement is possible in each case. This involves the establishment of a standard of performance against which current performance can be measured. The development of proper yardsticks for this purpose calls for careful study and the use of much common sense.

Without such yardsticks it is, of course, possible for an inspector to go through an arsenal or depot and form an impression—qualitative rather than quantitative—an impression which may result in an opinion largely unsupported by factual evidence.

When actual performance is checked against proper yardsticks of standard performance, the matter is removed from the realm of personal opinion and a quantitative measure of the potential improvement is obtained.

Manpower

The over-all manpower situation was one of the first elements in the program to receive attention. We have instituted a system of manpower surveys which will cover each Army Ordnance installation or activity in the United States. These surveys measure the effectiveness of manpower utilization at the particular installation under study, comparing current output per worker with past performance and with the output currently being obtained at other installations where similar activities are carried on.

The reports tell us whether a given installation is on the upgrade or on the downgrade, as far as output per worker is concerned, and also indicate the relative effectiveness of similar operations in different installations. The results must be interpreted very carefully, and full allowance must be made for all differences in local conditions which affect the output per worker.

However, although these surveys indicate the areas which require improvement, they do not, in themselves, provide the answer as to how the improvement can be made, nor do they give a sufficiently accurate standard of performance which we can apply to the output of the individual worker. Accordingly, it has been necessary to tackle that problem by other means.

New Techniques

About two years ago widespread publicity was given in industrial-management circles to new methods of analyzing manual operations and setting time standards. It was reported that applications of these techniques, in conjunction with methods engineering, which had been tried out by many of the management-minded corporations in American industry, had resulted in surprising improvement in worker effectiveness. These new methods had received a degree of labor-union acceptance which had never been achieved by time studies based on stop-watch technique.

Unlike stop-watch time studies which merely time the existing method, the new techniques establish a standard time by synthesis. In the process, needless motion and unsuitable tooling are picked up and eliminated by trained methods engineers.

To the Army Ordnance Management Office, this seemed to supply a possible answer to our problem, and if properly tied in with work simplification and methods engineering, would provide the next forward step required in the Ordnance management improvement program. Accordingly, a trial installation in a selected arsenal and in a selected Army Ordnance depot was begun on a contract basis, using the services of a leading firm of management consultants in this new field.

To date, the results have been fully comparable with the results reported by American industry in similar cases.

This marked increase in worker output is brought about by focusing the attention of trained methods personnel on the selection of the proper tooling for the job, the use of a jig or fixture of proper design, the use of efficient feeds and cutting speeds, the arrangement of materials, tools, etc., to effect a maximum output with a minimum of movement and effort on the part of the operator and by giving the operator a standard time against which to measure his actual performance.

The depot reports that, in addition to increased output, it is achieving marked savings in floor space.

Wage-incentive plans, which have been found so useful in industry in increasing output and in stabilizing unit costs, have been put into effect at various times in most of our manufacturing arsenals. They have not in the past been applied to depot operations, because these operations, even in overhaul and rebuild shops, have not been considered sufficiently repetitive and sustained to justify piece rates.

Plans Discontinued

Following the Second World War, the level of manufacturing operations in our arsenals dropped to such low ebb that existing wage-incentive plans were discontinued. With the present levels of activity, the reinstitution of wage-incentive plans appears desirable. One manufacturing arsenal has already submitted a plan which is now before the Wage Stabilization Board for approval, and other arsenals have the matter under study.

It is the hope of the Management Office that the more precise timing of operations which can be achieved through the new methods will provide a far better base for setting equitable piece rates and group rates than the experience statistics which have been used in the past.

It also seems reasonable to anticipate that such time studies will provide an acceptable basis for extending our wage-incentive plans to the larger rebuild and renovation operations in our field-service depots, with a consequent increase in output and a lift in employee morale.

As a result of the Korean crisis, it was necessary to modify many of the normal peacetime procedures governing Army Ordnance operations, and a flood of new instructions was superimposed upon an already voluminous set of instructions embodied in Army Ordnance orders, memoranda, bulletins, technical instructions, etc.

Reference Needed

This situation, created at a time when Army Ordnance ranks were being swelled by an influx of new employees, made it imperative that instructions covering Ordnance Corps standard operating procedure be gathered together, condensed, and put into ready reference form. This project, formidable in its ramifications, is being carried out by the Management Office in collaboration with the operating divisions.

Government paper work and Government red tape have always been a problem. In this area, our practices compare unfavorably with those of industry from a management standpoint. Many more pieces of paper are required in Government operations. Some aspects of this problem are based on law; others are also beyond the purview of Ordnance management activities.

An Example

For example, in the Army reporting system, many reports which originate in our depots, arsenals, and districts flow through the Office of the Chief of Ordnance to the General Staff level. Here they are consolidated into Army-wide statistics. For reasons of convenience, these reports from the various technical services (and, sometimes, from other field activities) must reach the staff in uniform format, and their format and content cannot be modified readily, even though their usefulness to Ordnance might be increased thereby.

Within the Management Office there is a group of trained statisticians who are constantly seeking to improve our report forms and reporting procedure and to extract the statistical data of significant interest to the Chief of Ordnance and to the responsible division heads. Information covering the most important aspects of current Army Ordnance activities are presented in graphic and tabular form to the Chief of Ordnance. This information, which is continually revised and kept up to date, is as detailed as the particular situation demands. As a program becomes more critical, the statistical data are provided in greater detail and with greater frequency.

This effort to improve Ordnance reporting procedure has pointed up the need for better equipment than is now available. At the present time, Army Ordnance operations are being conducted on a world-wide basis and pertinent information on procurement, distribution, rehabilitation, and renovation must be both accurate and up to date. It is essential that we maintain constant and accurate information at one central point on the status of our world-wide stocks.

Consider the magnitude of this problem. The inventory to be accounted for includes some 325,000 different line items, with an aggregate value of about nine billion dollars, housed in depots in various parts of the United States. Requisitions against this stock are flowing in from the forces in the Far East, our own growing forces in the United States, and our allies receiving American arms aid in various parts of the world. Receipts to this inventory are arriving in increasing volume from new procurement and from our own overhaul and renovation operations.

Some months ago the Chief of Army Ordnance decided that a check of our inventory control and forward buying methods against those employed in industry by the big mail-order houses might be helpful and might enable us to improve the existing Ordnance set-up. Accordingly, we approached Sears-Roebuck, who were most helpful and lent us two of their top-flight experts in this field for the purpose of surveying Army Ordnance methods and practice.

Their report was both reassuring and helpful; reassuring in their finding that our methods and equipment are comparable to modern commercial practice, and helpful in pointing out where additional refinements and improvements could be introduced.

Time Lag

With the present equipment, which conforms to that of similar large operations in industry, there is an excessive time lag which introduces the element of "float" and requires an educated guess on the part of the central control office. Our inquiries developed the fact that this need for faster electronic equipment had already been felt in industry.

Developments to date point to the possibility of new machines which will automatically carry forward stock balances and instantaneously answer at the national stock control point when queried regarding the balance on hand of a particular item at any or all depots in the system.

When you consider that a single depot often deals in approximately 200,000 different items on which running balances would be required, the magnitude of the task is apparent.

The Army Ordnance Management Improvement Program, as published to all commanding officers, lists eight elements, such as organization review, appraisal studies, procedural review and analysis, work simplification, and establishment of the statistical and cost analyses and controls, recognized as essential to good management.

Technical Service Audit

At the same time that the Ordnance Corps is carrying through with its own management improvement program its operations are being scrutinized by the Comptroller of the Army, who is currently completing a management audit of the Army technical services. This management audit of Army Ordnance has been in progress for more than a year. It is very comprehensive in scope, and it is anticipated that the conclusions and recommendations of the survey team of the Comptroller of the Army will be available to the Chief of Ordnance this winter. This report will enable us to check our own estimates of the efficiency of our organization and operations against the conclusions of an outside group.

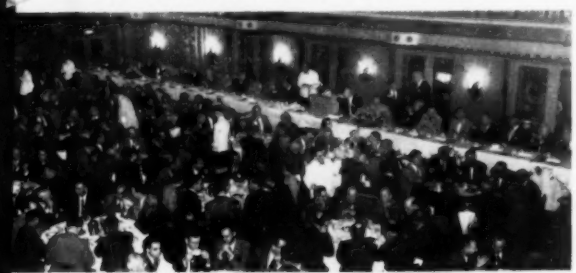
Aircraft Armament — A Power for Peace

Theme of the Thirty-Third Annual Meeting of the American Ordnance Association

On stage at the opening session in the Grand Theater were, left to right: Burton O. Lewis, Harvey C. Knowles, James L. Walsh, Col. J. F. Babcock, Louis Polk, Brig. Gen. G. A. Blake, H. R. LeBlond, Comdr. W. H. Keighley, Col. B. S. Mesick, and Capt. H. P. Cooper.

Left to right above are Maj. C. S. Comeaux, director, New York Post; H. R. LeBlond, vice-president, Cincinnati Post; Louis Polk, Post president; and Capt. H. P. Cooper, U.S.N.

Speakers on aircraft armament at the morning session in the Grand Theater were, left to right: Col. René R. Studler, Col. B. S. Mesick, Comdr. W. H. Keighley, and Capt. H. P. Cooper.



John S. Pfeil and Harvey C. Knowles, vice-presidents of the A.O.A., left to right above, chat with Frederick V. Geier, right, a director of the Cincinnati Post, before luncheon.

Maj. Gen. E. L. Ford, Chief of Army Ordnance, below, addressed the members at the annual Industrial Mobilization Luncheon, left.

Left to right, below: H. S. Robinson, Cincinnati Ordnance District chief; Rear Adm. M. F. Schoeffel, Navy Ordnance chief; and Maj. Gen. Fred. R. Dent, Jr., commanding the Wright Air Development Center.

F. V. Geier, director of the Cincinnati Post, left above, and Harvey C. Knowles, A.O.A. vice-president, right, present the Post's Charles L. Harrison Medal to C. E. Wilson, president of General Motors Corporation.

James L. Walsh, president of the Association, was toastmaster at the record-breaking dinner meeting.

Gen. Nathan F. Twining, Vice Chief of Staff, U.S. Air Force, spoke at the Thirty-Third Annual Dinner.

C. E. Wilson, General Motors president, was the principal speaker at the dinner in the Netherland-Plaza Hotel.

Gen. B. W. Chidlaw, commanding the Air Defense Command, left, and E. R. Godfrey, director of the American Ordnance Association, right.

Hon. J. F. Floberg, Assistant Secretary for Air, U.S.A.F., also attended.

R. L. Biggers, vice-president of the A.O.A., is in charge of all local Posts.

- The Thirty-Third Annual Meeting of the American Ordnance Association was held under the auspices of the Cincinnati Post, with headquarters at the Netherland-Plaza Hotel, Cincinnati, Ohio, on October 4, 1951, and at Wright-Patterson Air Force Base, Dayton, on October 5th, where A.O.A. members were guests of the U.S. Air Force.

- The first day's program included an Aircraft Armament Session at the Grand Theater where a near-capacity crowd heard Army, Navy, and Air Force ordnance experts; an Industrial Preparedness Luncheon, attended by over 1,000 members and guests; visits to the Cincinnati Milling Machine and Procter & Gamble Company plants; and the Thirty-Third Annual Dinner illustrated below—the largest in the Association's history.

Charles D. Wiman, A.O.A. director, left, chats with Maj. Gen. A. W. Vanaman, commandant, Industrial College of the Armed Forces, right.

Part of the crowd of 5,000 A.O.A. members and guests who witnessed the air-power demonstration at Wright-Patterson Air Force Base.

American Ordnance Association officials and Air Force officers follow the colors as they lead the contingent of A.O.A. members and guests to the air-power demonstration area after leaving the special train which brought them from Cincinnati for this second session of the Annual Meeting.

AIRCRAFT ARMAMENT— A POWER FOR PEACE

• This was the theme of the Air Power Session of the Thirty-Third Annual Meeting of the A.O.A., held at Wright-Patterson Air Force Base, Dayton, Ohio, on October 5, 1951. A special train brought the Ordnance contingent from Cincinnati where the first session of the meeting was held. Many also came by private automobile.

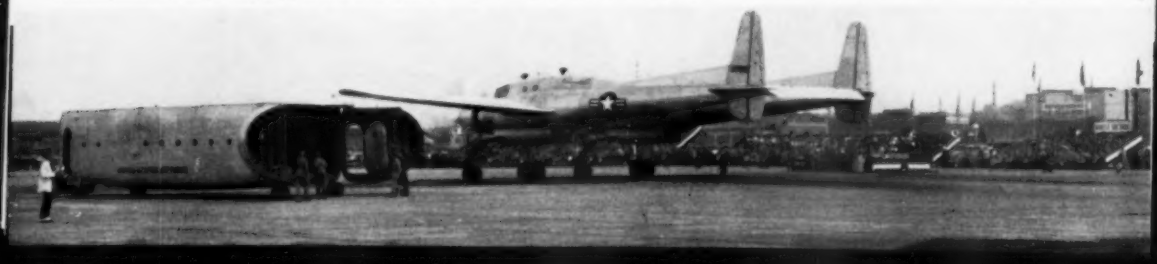
• After leaving the train the Ordnancemen marched to the demonstration area where they filled the grandstands to their 5,000 capacity. The session was opened with an address of welcome by Lieut. Gen. E. W. Rawlings, commanding general of the Air Matériel Command, and proceeded with an outstanding display of air-ordnance power as shown in the accompanying official U.S. Air Force photographs.

Lieut. Gen. E. W. Rawlings, head of the Air Matériel Command.

Maj. Gen. F. R. Dent, Jr., describes new developments.

Col. J. T. Morris is in command of Wright-Patterson AFB.

Ordnancemen see cargo-carrying pod detached from bottom of the XC-120, below, as pageant of Air Force progress moves before the grandstand.



Climax of the morning program of the Air Power Session at Wright-Patterson Air Force Base on October 5th was the dramatic demonstration of the load-carrying capacity of the huge C-124 Globemaster transport airplane which discharged 200 fully equipped soldiers from its cavernous maw.

A perfect example of firepower and mobility, these 200 troops of the 11th Airborne Division, U. S. Army, from Camp Campbell, Ky., stand at attention in front of the stands and report "ready for combat" after disembarking from the C-124 Globemaster in the background of the photo.

Three F-86 Sabre jet fighters, above, take off in a demonstration of precision formation flying and aërobatics that left the crowd gasping. Right, an F-94 jet night interceptor leaves the field in a steep climb with jet-assist take-off units.

Among notables in A.O.A. guest section were (second row, left to right): Maj. Gen. J. K. Christmas, Gen. N. F. Twining, H. R. Boyer, and Lieut. Gen. B. W. Chidlaw.

View of the demonstration area showing the crowded grandstands with a number of Air Force exhibits passing in review while being described over an address system.

Pioneers in American Aircraft Armament

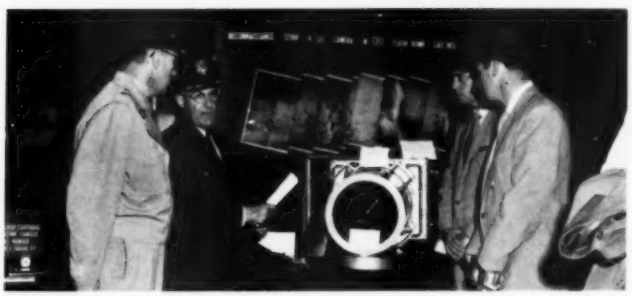
In this historic photograph are shown the late Maj. Gen. William Crozier (right), distinguished Chief of Ordnance, United States Army, 1901-1918, and Orville Wright (1871-1948), famed American inventor of heavier-than-air craft. These two great men symbolize the engineering genius and imagination which have resulted in America's phenomenal development of aircraft in relation to our national defense.

Many of the amazing results of their pioneering efforts were shown in the latest adaptations at the Thirty-Third Annual Meeting of the American Ordnance Association at Wright-Patterson Air Force Base, Dayton, Ohio, October 5, 1951, pictures of which appear in these pages. The first military appropriation of the Federal Government for the development of heavier-than-air craft was made by the Board of Ordnance and Fortification in 1898.

The above photograph was taken at Dayton some years ago by Mrs. Crozier, widow of General Crozier, and through her kindness was made available to the editors of ORDNANCE magazine for publication in this issue.

"Air Ordnance Power for Peace," the theme of the Thirty-Third Annual Meeting of the A.O.A., was prominently displayed above the exhibits in the huge hangar at Wright-Patterson Air Force Base. Among exhibits was a captured Russian-built Yak-11 airplane, shown at the extreme left, which has now been repainted with U.S.A.F. markings.

Viewing a model of the world's largest forging press among the exhibits are, left to right: B. E. Rogers, works manager, Winchester Repeating Arms Company, New Haven, Conn.; B. E. Bassett, regional manager, Olin Industries, Inc., East Alton, Ill.; and W. M. Hurley, works manager, Western Cartridge Company, East Alton, Ill. The giant forging press of which this is a model has a capacity of 75,000 tons.



Examining an aërial camera display are, left to right: Brig. Gen. A. R. Maxwell, of the Air Research and Development Command; Col. George W. Goddard, Wright Air Development Center; T. H. Orndorff, Wright-Patterson Air Force Base representative, Brooks & Perkins, Inc., Detroit, Mich.; and Charles I. Vogel, general sales manager, Brooks & Perkins, Inc. Below, a B-29 flies by with two props feathered.

Automatic Small Arms

"The Machine Gun" Is Encyclopedic in Data and Detail

by

Melvin M. Johnson, Jr.

The Navy Bureau of Ordnance has made an enduring contribution to the national defense in preparing this complete and authentic volume

THE Bureau of Ordnance of the Navy has made a remarkable, complete, and enduring contribution to the national defense in causing officially to be prepared and published (U.S. Government Printing Office) "The Machine Gun," ably authored by Lieut. Col. George M. Chinn of the U.S. Marine Corps. This historic work was the subject of an article in the preceding issue of ORDNANCE (September-October 1951, Vol. XXXVI, No. 188, pp. 246-247) with a preview in the January-February 1951 issue (Vol. XXXV, No. 184, pp. 307-308). In this review I will touch upon some of the more technical aspects and lessons in development and practical engineering which this undoubted masterpiece contains.

Service Machine Guns

As Colonel Chinn's complete bibliography indicates, there have been a number of modern books of some scope which included "machine guns" along with other automatic and semiautomatic arms. Encyclopedic in data and detail, Colonel Chinn's Navy work is strictly confined to machine guns which have seen any service use.

Within this category the author includes "light machine guns" under the European definition, and thus covers American "automatic rifles" such as the BAR. At the other extreme are included aircraft and antiaircraft machine cannon, automatic guns, or automatic cannon as these larger caliber arms are variously described and defined. Various historic manually operated machine guns, such as the Gatling, are also treated.

There are a number of enforced omissions due to Government policy, notably references to those of Russian-originated machine guns and their background. Such unavoidable and necessary censorship by the Navy unfortunately puts this monumental volume in the same position as a history of the evolution of music which omits every Russian composer. This reviewer urges every one to unite in a fervent hope that the time will come soon in world affairs when Colonel Chinn may prepare and release in supplement a corresponding coverage of Russian machine guns and their background.

It is interesting at least to note that a half century ago two Americans provided the principal machine guns of the Russo-Japanese War, the Russian Maxim and the Japanese Hotchkiss, and that modifications of these guns saw service in World War II.

This book's purpose is to set forth past evolution and development in some detail as a source of guidance for the future of improved ordnance. Many authors faced with such a task would have so confined their presentation as to limit its use to those of the gun fraternity—not so Colonel Chinn. "The Machine Gun" has much to offer engineers, industrialists, military men, policy makers, and leaders in any field of endeavor.

Machine guns are, after all, just another type of complex machine, unusual in many engineering aspects. The trials and tribulations of those concerned with machine-gun development also constitute a fascinating, frequently frustrating history of human affairs, eloquently presented in fluent, easy prose by Colonel Chinn as an essential part of his historically accurate theme.

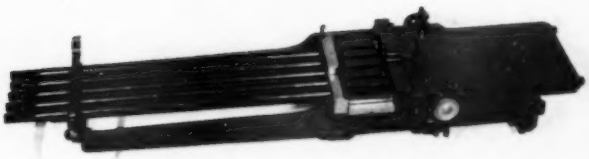
Lieutenant Colonel Johnson, Ordnance Inactive Reserve, is a well-known automatic arms expert, inventor, and author.

Early Efforts

"The Machine Gun," like all histories, begins at the beginning. It describes the earliest attempts to achieve volume of fire. Until late in the nineteenth century some form of manual operation was required to actuate gun mechanisms. In describing the surprising variety of these "machine" guns, Colonel Chinn provides a clear, concise picture of important mechanical details. Probably the most notable of the pre-automatic guns was the American Gatling, developed by Dr. Richard Jordan Gatling, from whose name and gun the slang term "gat" was coined.

Many readers will be surprised at the longevity both of Gatling and his system, for it began before the American Civil War and lasted until just prior to World War I. Operated by a hand crank, a series of six to ten barrels with their actions were caused to spin wheelwise on a central longitudinal shaft with a common feed box or drum. Each unit fired at a given stage and passed on around, emptying the breech and reloading in cycle. By cranking rapidly and replacing magazines, a Gatling assembly could fire at the rate of as much as 1,000 shots a minute. In 1873 a caliber .50-70 Gatling fired 64,000 rounds in one day of a U.S. Navy test. Gatlings were available to General Custer but unfortunately were left behind just before the Little Big Horn massacre.

A native of North Carolina who



This illustration of the old Nordenfelt hand-operated machine gun with its five barrels is one of the many authentic photographs from "The Machine Gun."

later lived in Cincinnati, Gatling was pro-Union in the Civil War but encountered some political difficulty due to suspicion of his sympathies. He lived to see his gun fired at 3,000 rounds a minute, electrically powered, before his death in 1903.

Acrimonious Debate

Guns of the Gatling manual-machine-gun type were accepted by the military only after extended and often acrimonious debate. A major misconception was the tactical application. Thus the Montigny mitrailleuse, which had the appearance of an artillery piece, was used by the French as such, with poor results. Once, however, when properly used with infantry, these guns inflicted severe losses upon the Prussians (1870).

One of America's most outstanding inventors and development engineers was Hiram S. Maxim of Maine who in 1883, while residing in England, created the first successful automatic machine gun by using the force of cartridge discharge to perform mechanical operations. Maxim's principal gun was of the short-recoil-operated type. Widely employed throughout the world in various calibers even prior to 1900, a modification of this gun is still used by Great Britain and Russia. Queen Victoria knighted Sir Hiram who had become a British subject. Germany had 50,000 Maxims in service by 1917, the U.S. a few hundred. The British version was known as the Vickers-Maxim.

Hotchkiss

Late in the 1870's Benjamin Hotchkiss of Watertown, Conn., who had gone to France, developed a revolving cannon. Founder of the Hotchkiss Company in France, his firm later developed the gas-operated Hotchkiss machine gun (Odkolek patents). This gun was used by the Japanese in 1900, by the French in 1914-1918, by the U.S. (French-borrowed), 1917-1918, and by the Japs, 1941-1945.

John M. Browning, of Ogden, Utah, was the world's most prolific and most famous arms inventor and engineer of modern times. His amazing work and many hitherto undisclosed details of his career are all presented in a most interesting fashion by Colonel Chinn.

Browning's first machine gun was known as the Colt-Browning, a unique gas-actuated, belt-fed, air-cooled piece. Because of its radial gas-impacted lever system, this U.S. Navy and later Army-adopted gun was called the "potato digger." Although standardized before 1900, very few were on hand in 1917. Russia and Canada also used some of these guns.

In 1900 Browning first patented his most famous Browning short-recoil-operated, belt-fed, water-cooled machine gun. This system was the basis for the U.S. M1917 gun. Colonel Chinn describes how, lacking U.S. support, Browning was forced to develop sporting arms until 1910 when he had acquired enough funds to continue actively with his new weapon. It was adopted and produced just too late for World War I, a few reaching France in October 1918.

By 1921 Browning had this system built as the U.S. M1921, caliber .50. For World War II the U.S. had in caliber .30 the Browning M1917, M1919A4, M1919A6, M2 aircraft; in caliber .50, the M2 aircraft, M2 water-cooled, M2 HB (heavy-barrel) ground, and M3 aircraft (1,200 rounds a minute). Like all his fraternity, Colonel Chinn's history indicates the inventor's numerous troubles with the U.S. Government.

Died in Belgium

Some of Browning's work was accomplished in Belgium with the Fabrique Nationale. He died there in 1926, the world's greatest machine gun inventor. The tangible expressions of gratitude he received from his own country were not such as to inspire others to follow his trail. Colonel Chinn has contributed a fine record and written enduring pages covering the works of a very great American.

The book also covers Browning's M1918 automatic rifle and mentions his M1911 Colt pistol. Browning developed some dozen of Winchester's most popular sporting arms, including the Model 1894 .30-30 carbine and M1897 pump gun; Remington's autoloading rifle, autoloading shotgun, and a variety of .22's, and a Stevens pump gun. His Browning autoloading shotgun, various pistols, and an over-under shotgun were sold by his own company, by Colt, and by Fabrique Nationale.

The Lewis Gun

Born fifteen years after Maxim and two years after Browning was Col. Isaac Newton Lewis, U.S. Army (Coast Artillery). About 1910 Lewis became interested in an unperfected design of a gun by one Samuel McClean. The result of an intensive development program was the Lewis light machine gun, which represented a considerable advance over the U.S. M1909 Benét-Mercié light machine gun, a Hotchkiss-type strip-fed weapon.

Colonel Chinn has written a most interesting factual account of Lewis and his gun which was used principally as a platoon weapon by the British and also as an aircraft weapon in World War I.

Mechanically the Lewis was a gas-actuated "straight-pull" turn-bolt arm. The gas-impacted cam slide forced the

bolt to rotate and carried it rearward. The drum or "pan" type feed held 47 or 97 rounds. Viewed in the abstract, and in the light of later experience, this reviewer does not share quite the enthusiasm of Colonel Chinn for the Lewis system because it tends to aggravate the natural resistance of bolt rotation in forcing the bolt to unlock by a rearward-moving cam slide. Improper timing of the slide prior to bolt camming was the Lewis gun's "Achilles' heel," as the author discloses.

Tactically, the Lewis was one of the first successful major advances toward a machine gun which could keep up with the supported troops. It combined mobility with firepower. There is every evidence that the British army gained a vital advantage at a most critical time from adoption of the Lewis gun. The U.S. Navy and Marine Corps adopted the Lewis, but the U.S. Army and its Ordnance Department refused to adopt it. The result of this was an unusual political controversy which even today is not forgotten.

The Navy's book on machine guns is rather pro-Lewis. Such an authority as Maj. Gen. Julian S. Hatcher appears somewhat anti-Lewis only on strictly technical grounds. Possibly the developments of the Berthier and BAR which followed the Lewis influenced the situation.

Valuable Reading

Colonel Chinn has written down the facts and has thrown much additional light on the subject. His book would be valuable reading for the Lewis chapter alone. The lessons in the Lewis story are many, and they are for the reader, not the reviewer, to judge. But every one interested in national-defense problems should read Chinn on Lewis with care.

Lewis was a stormy West Point petrel. Some say the Lewis feed was correct for British rim-type .303 ammunition, not for U.S. rimless .30-06. Chinn introduces technical data relative to mechanical adjustments and increased "dwell-time" dimensions, used by the embattled British and ignored or not known by our Ordnance experts, which made the Lewis function well in combat but fail in U.S. tests for lack of sufficient dwell-time.

This reviewer must point out that the United States entered World War I with a total of some 1,100 machine guns of four types, including the perhaps unfairly discredited M1909 Benét-Mercié. While the British were fighting very successfully with the American Lewis we were fighting about the Lewis.

No U.S. Guns

The A.E.F. did not fight the war of 1917-1918 with the Benét-Mercié, or with the tardily developed BAR, or with the unsung Berthier, or with the battle-tried Lewis. They did not have any light machine gun or any U.S. .30-06 gun. They had to *borrow* the Frommer-patented French Chauchat gun in French 8-mm. rim (and the M1914 French heavy Hotchkiss).

Most authorities, including Colonel Chinn and the French, regarded the Chauchat as one of the worst, if not the worst, light machine guns ever used, through necessity, in combat. Its only merit was relative ease of manufacture.

The Lewis gun, however, was used in aircraft. In 1937, Lewis guns were fired against Japs attacking the U.S.S. Panay. In 1942 Sergeant Edward Wojtycky, U.S.M.C., shot down a Jap flying boat off Guadalcanal with a "borrowed" Coast Guard Lewis loaded with 97 tracers.

"The Machine Gun" provides valuable and significant information as to gun developments during 1921-1941. These were for the most part European. National U.S. policy discouraged American development. While Europe made advances, especially in light machine guns and aircraft cannon, very little was accomplished here, except to refine the Browning guns (and develop semiautomatic rifles —not covered within the scope of "The Machine Gun").

According to Colonel Chinn, one advanced type of light machine gun was developed just prior to 1941 in the U.S.A., later used by the Marines in the Pacific and special Army combat forces in Europe with favorable results.

A Serious Gap

Thus the Navy's book of the world's recorded knowledge of machine guns points to this serious 1921-1941 gap in our development efforts. Germany produced the MG34 and through Polish inspiration the MG42 machine guns. The Germans developed the FG42 light automatic gun and a variety of ground and aircraft cannon of 15 mm., 20 mm., and 30 mm.

Thanks to the development in France of the Hispano-Suiza aircraft gun, we were able to procure a 20-mm. type for 1942-1945 combat. The detailed story of the complicated origins and later refinements of the "Hisso" should be of especial value to all professionals. Similarly, the Navy obtained antiaircraft autocannon from the Swiss (20-mm. Oerlikon) and Swedes (40-mm. Bofors).

Inventors Discouraged

The British resorted also to the "Hisso," Oerlikon, and Bofors. Faults though they had, these weapons were vitally needed. This country might have developed better models if the genius of Gatling, Maxim, Browning, Lewis, Benét, Hotchkiss, *et al.* had been encouraged. But Colonel Chinn emphasizes that such encouragement of American weapons genius was notably lacking. Arms work was even reviled. For example, in 1934 a "munitions monger" investigating committee of the U.S. Senate was actively headed by Senator Gerald Nye, whose committee counsel was another type of American genius, Alger Hiss, of late more prominently known in other connections. The American arms industry was confined to sporting arms.

Continuing in his survey, Colonel Chinn covers the Czech-invented British Bren light machine gun which replaced the Lewis by 1938, the French Chatellerault light machine gun which replaced the Chauchat in 1924-1929, and various other European and Japanese guns.

It would be impossible within the scope of this review to sum up all the

many lessons found in "The Machine Gun." Machine guns have played a major part in the great decisive battles of the past century. By far the great majority of machine-gun engineers were Americans. In almost every case, they met with discouragement and even bitter resistance.

By far the great majority of successfully used machine guns are traced to the initiating genius of an inventive engineer who had a combination of aptitude, imagination, tenacity, and native intelligence. None was ordained by executive fiat to do the job. Background, breeding, education, birthplace, appear to have been unconnected for the most part. Individual follow-through appears to have been a big factor.

Military Boards Haggled

The conception even of tactical use of the guns seems to have been quite unconnected. Military boards and authorities met and pontificated, wrote up *ex post facto* requirements, haggled over details and policy. It was left for the Gatlings, Maxims, Brownings, Lewises, *et al.* in most cases to conceive the weapon and also its uses; then to try to sell the idea afterward against stiff opposition.

Colonel Chinn emphasizes, nevertheless, the fact that much valuable refinement of many weapons resulted from organized Ordnance and industrial effort. The tireless work, for example, of Ordnance-expert Col. René Studler prior to the Second World War to arouse U.S. interest in European aircraft cannon, the many contributions of ordnance engineer Dr. S. G. Green to the Browning guns, the fine engineering work of many industrial concerns here and abroad in the final development and successful production of "the machine gun" and its ammunition, are all carefully noted.

Colonel Chinn comments on the unfortunate wartime division of machine guns in Army Ordnance according to their caliber. Thus artillery experts, quite unfamiliar with machine-gun needs, were obliged to deal with the 20-mm. "Hisso" because it was larger than caliber .60 (15 mm.), the "small-arms" ceiling by definition. This has since been corrected.

A specific lesson is seen in the unfruitful military tendency to set up detailed requirements for new guns, or to have conflicting or compromise requirements, or to have no perception of changing needs. The obvious answer appears to lie in maintaining only broad general requirements. The "command complex"—ordering an arsenal or a branch to go and invent a gun—appears on the record to have been most unproductive in machine-gun progress.

Of the six American machine-gun inventors and development experts named in Webster's Biographical Dictionary and described by Colonel Chinn, five are dead. Colonel Chinn does not imply that we should throw ourselves to the mercy of every crackpot or wide-eyed graduate who believes himself an inventor. His book abounds with records of intelligently applied inventive aptitude, however, both as to individuals, groups, and as to industry.

Achievements Recorded

The achievements of Colt with Browning, of Z.B. with Vaclav Holek, of Hispano-Suiza with the senior Birkigt, of Oerlikon with the ideas of Scotti and Becker, of Madsen with the spark of Schouboe, of the Mauser works, of Rheinmetall-Borsig, all are recorded.

In a frankly critical vein the author states that the Germans attempted to develop tomorrow's weapons today; the U.S., today's weapons soon. The alert attitude of the Germans in taking an obscure Polish inventor's automatic system and promptly building an improved machine gun, the metal-stamped MG42, is one of many cases in point; their Lewis-actioned FG42 with other American-copied features is another.

The story of why we failed to make a good .30-06 copy of the 7.92-mm. MG42 during the war is told. Lack of applied gun know-how resulted in failure to allow for the increased cartridge length of the .30-06 versus the 7.92 mm.

Groundwork for Novels

Colonel Chinn has laid the groundwork for numerous novels and moving pictures. Hollywood should study the Gatling, Maxim, Browning, and Lewis stories for the great inspiration they provide.

Any one who proposes to improve on Colonel Chinn's Navy book will have to get up before dawn and stay up late at night for many moons.

"The Machine Gun" is most enthusiastically recommended by this reviewer. It constitutes *the* book on machine guns. It reflects the highest credit upon the author and his assistants, Leo X. Abernethy, Franklin Clark, and M. Sgt. John H. Moore, U.S.M.C. It comes to the public as another fine contribution to our technical advancement by the Navy Bureau of Ordnance.

The Madsen machine gun, illustrated here with water jacket from the book by Lieut. Col. G. M. Chinn, has been manufactured in some form for fifty years.

Month by Month: High Lights of the National Defense

Rifle Standardization

Representatives from Canada, the United Kingdom, France, and the United States gathered in secret Pentagon sessions in August to deal with a crisis that had developed in the program for standardization of a rifle for the forces of the North Atlantic Treaty Organization.

The crisis centered around two experimental lightweight automatic rifles —the British caliber .280 and a lightweight automatic caliber .30 rifle being developed by U. S. Army Ordnance.

The Ordnance rifle, a post-World War II development, is called the T25. It has a 20-round clip, weighs 7 pounds, and has a cyclic rate of 700-800 rounds a minute. Later, Ordnance developed another automatic rifle and put it in competition with the T25. Both American rifles use a caliber .30 cartridge.

Shortly after World War II the British recognized the need for replacing their veteran bolt-action .303 Enfield and had initiated development of a lightweight automatic rifle of their own. One model was built by the Enfield Arsenal, another was built by the Fabrique Nationale Arms Plant in Belgium. Both were caliber .280.

The U. S. delegation, led by Secretary of the Army Frank Pace, demonstrated the impracticality of standardizing on a caliber .280 for the following reasons:

1. From the standpoint of economics, it was undesirable.

2. The parallel production problem of supplying the .280 rifle and the caliber .30 to North Atlantic Treaty Organization countries was overwhelming.

3. Many NATO countries already have a considerable investment in caliber .30.

4. The target date for complete arming of NATO countries would necessarily be put off by at least four years if the .280 were adopted.

5. A U. S. shift to .280 would not, as the British contended, be cheaper and more feasible, but on the contrary, more expensive.

6. Ordnance could never get Congress to appropriate money for ammunition and a rifle that did not even meet U.S. standards, and especially one that did not begin to match the quality of our M1 (Garand).

The British delegation did not answer the compelling arguments presented by the United States. They agreed not to go into production on the British rifle.

At the end of the Pentagon conference a joint statement was issued: "It was unanimously agreed that any decision on the adoption of a new round of small-arms ammunition would not affect the immediate situation and that, in order to permit the arming of NATO countries as rapidly as possible, the presently accepted standard ammunition and weapons should be continued in production for some time."

The statement added that "at the same time it was unanimously agreed that as early as practicable a new round of small-arms ammunition should be adopted."

A complete breakdown in the NATO small-arms standardization program was avoided, at least, but relatively little progress was made toward the ultimate goal: a one-rifle, one-ammunition army. The British rifle has been staved off for the present, and it was at least agreed that a new small-arms round would be adopted for the future, after tests and development. Meanwhile, authentic word on the present status of our own light rifle, its characteristics and its status, is anxiously awaited. Until then our M1 rifle, with possibly some minor modification for weight reduction, is still tops.

Atomic Ordnance Demise?

On the very day that the Air Force was announcing that it had let a contract for the construction of an atom-powered airplane, Dr. James Bryant Conant, president of Harvard University, predicted before the American Chemical Society the unlamented end of the "atomic age" within another decade or two.

Dr. Conant believes that a third total war fought with atomic weapons will be averted, basically because the realization will finally come home that atomic weapons are simply unsuited to the real military problems of the coming years.

In each moment of crisis the military men will be unable to guarantee success if atomic war is begun; the military problem will be met not by threatening unlimited slaughters of population but by providing the forces practically able to prevent "invasion by foreign soldiers."

As a balance is built up, the atomic weapons will be seen to be as unnecessary as they are horribly dangerous—dangerous to the user as well as the victim—and a real system of inspection and ultimate abolition will become possible.

Dr. Conant believes that within ten or fifteen years it will begin to appear that the exploitation of atomic fission is a "game not worth the candle," either militarily or for civil power production. It will not prove an "expedient" source of power because of the immense capital investment it demands, because of the difficulty of disposing of its dangerous radioactive wastes, and because a much better power source will finally be found by science in the inexhaustible energy of the sun.

Dr. Conant's prophecy, while shared by few military or civilian experts, is worthy of the utmost respect. We can at least agree with him that it should be possible to find our way out of the horrors of the "atomic age" through present courage, firmness, readiness for hard thought, hard work, and hard sacrifice.

Better still would be the prospect of outlawing the bombing of civilian populations whether by A-bomb or high explosive. That, at least, would be a long step toward sanity during a war and after it.

The Horse Marines!

The Marine Corps and the Army have adopted divergent policies with respect to horses.

The Marines have instituted a special course in the use of pack saddles and horses at the Marine Corps Base, Quantico, Va. The Army is still firmly against the reconstitution of horse cavalry in the Army and has so advised Congress.

The Marine Corps course is designed to teach platoon commanders the use of the horse in modern combat. Instruction is given in the tactical use of the packsaddle, care of the animal, riding techniques, tactical employment of animals, and the carrying of ammunition and supplies over rough terrain under combat conditions.

The Marines said that the need for pack animals in combat was demonstrated in Italy and Burma during World War II and more recently in Korea. The first class of twenty-five second lieutenants recently completed the course, and a second class with the same number of officers is now in progress.

The Army doesn't love Nellie any more and reported to the House Committee on Armed Services in opposition to HR 3338, a bill to "reactivate the mounted cavalry."

The Army decision to replace Nellie by motorized and mechanized units "was made only after an exhaustive consideration of the missions, functions, responsibilities, resources, and requirements of the Department of the Army."

Taking another deep breath, Army spokesmen stated that "this matter was thoroughly studied by boards of senior officers established to consider the reorganization of the Army following World War II. The reports of these boards all recommended the discontinuance of the cavalry as a separate arm and further recommended that the functions of the former Cavalry Arm be assumed by an Armored Arm."

The Board declared its belief that the experience of the last two wars "clearly indicates that the horse has lost its usefulness on the battlefield. The reconnaissance and exploiting rôle which, in the nineteenth century, was carried out by cavalry still exists but is now carried out by light and heavy armored vehicles or a combination of both types."

That is the status of the question at the moment: to horse or unhorse. There are a great many supporters of the stand taken by the Marines!

Guided Missile Progress

The Air Force must now wrestle with a host of new problems along with its new guided missile, one of the "fantastic" new weapons mentioned by President Truman as an integral part of the American arsenal.

Some of these problems are as complex as keeping an enemy from taking over guidance of the missiles. Some are as prosaic as forming personnel organizations.

In announcing in September that a flying guided bomb called the "Matador" and designated as the "B-61 pilotless bomber" was in production, the Air Force had nothing to say about the methods used for steering the clipped-wing missile to its targets against enemy troops or fortifications.

The public announcement that such a missile is ready for combat implied also that the Air Force must have reason to believe it can retain control of such missiles while they are speeding over enemy territory.

Developers of the guided missile are known to have given great attention to methods which would foil an enemy attempt either to jam the radio frequencies over which the guidance signals are sent or to seize actual control of the missile by use of greater power at the same frequencies. If this could be done, the enemy might either divert the missile from its intended target or actually turn it around and head it back to strike at the original launchers.

In combat with the new weapons, the old "command of the air" expression will have an added meaning. Not only must air domination be maintained by superior numbers or quality of fighter planes but the command of the radio waves themselves must be assured.

The Air Force announcement that the 1st Pilotless Bomber Squadron was formed at the Cocoa (Fla.) missile test center on October 1st may explain in part why various officials, military and congressional, have been talking in recent months of expanding the size of the Air Force far beyond the present 95-wing goal. Some of this expansion may provide, in the future, operational wings of guided-missile outfits, of which the 1st Squadron would be a nucleus.

Guided missiles, whether the jet-powered type, the B-61, or rocket-driven missiles, operate at speeds ranging above that of sound (761 miles an hour at sea level) up to more than 1,000

"It requires no sage to predict events so strongly foreshadowed to us all; still 'Westward' will 'the course of empire take its way.' But the last act of the drama is yet to be unfolded; and not withstanding the reasoning of political empires, westward, northward, and southward, to me it seems that the people of America will, in some form or other, extend their dominion and their power, until they have brought within their mighty embrace multitudes of the islands of the Pacific, and placed the Saxon race upon the shores of Asia.

"And I think too, that eastward and southward will her great rival in future aggrandizement (Russia) stretch forth her power to the coasts of China and Siam; thus the Saxon and the Cossack will meet once more, in strife or in friendship on another field.

"Will it be friendship? I fear not! The antagonistic exponents of freedom and absolutism must thus meet at last, and then will be fought that mighty battle on which the world will look with breathless interest; for on its issues will depend the freedom or the slavery of the world—despotism or rational liberty must be the fate of civilized man. I think I see in the distance the giants that are growing up for that fierce and final encounter; in the progress of events that battle must sooner or later inevitably be fought."—
COMMODORE M. C. PERRY, United States Navy, March 6, 1856.

miles an hour. In the case of the big, high-altitude, experimental rockets, speeds higher than 3,500 miles an hour are reached.

Atomic Energy Report

The Tenth Semiannual Report of the Atomic Energy Commission indicated that the Commission had conducted limited-scale weapons tests in January and February on the Las Vegas Bombing and Gunnery Range in Nevada with logistic support by the military services. In April and May the Commission and the Department of Defense jointly conducted a full-scale test program at the Eniwetok Proving Ground in the Pacific's Marshall Islands.

Other experiments were carried out to determine the effects of atomic radiation, burns, and blasts on living things, and to obtain additional data as to the effects of atomic-weapon explosions on structures, aircraft, and various materials.

Experience in the 1951 tests of atomic weapons demonstrated definitely that lingering radiation need not delay rescue and recovery work after bombing by high air bursts. Direct radiation from a high air burst disappears almost immediately as the radioactive cloud rises into the stratosphere, and there is no dangerous residual radiation at ground level. A burst close to the ground leaves considerable residual radiation in an area 300 to 400 yards in radius, but destruction within this circle would be practically complete.

For the primary purpose of providing data to develop treatments of atomic-bomb casualties, the tests at Eniwetok included exposure of many mice and a few dogs and pigs under various conditions and at various distances from the explosions.

Preliminary analysis indicates the tests will provide definitive answers on radiation distances, dosages, and energies, and the factors involved in the thermal burns. Reports on immediate effects of the tests will be completed this year.

Buildings of various materials and types of construction were erected within range of the Eniwetok explosions to develop information for building designs that would minimize blast damage. Some nine hundred measurements were made on twenty-seven different structures, including industrial-type buildings, dwellings, and underground and surface bomb shelters for military use. Glass and types of window construction were also given limited tests.

A limited experiment on the effectiveness of automobiles as a means of shelter against blast, heat, and radiation in an atomic explosion was made at the Nevada weapons test. Five automobiles were ranged at half-mile intervals from ground zero at one of the test explosions so that data could be obtained on the distances at which an automobile would afford some protection.

New Ordnance Research Center

Duke University has been chosen for the site of a nationwide research program sponsored by Army Ordnance. The newly organized Office of Ordnance Research will be a scientific clearing house for basic research of potential interest to Ordnance, to be carried out at universities, colleges, and other research institutions throughout the United States.

Dr. Marcus E. Hobbs, professor of chemistry at Duke, is now serving as acting chief scientist for the office and heads up a staff of twelve other scientists who, with outside referees and arsenal scientists, are evaluating basic research programs. The office will be a permanent establishment and is expected to expand.

Duke University was chosen for the site because of the local scientific activities, the technical information available through scientific consultants, laboratories and libraries, and because of the regional density of available scientists and other facilities. Duke is accessible to Army Ordnance arsenals and proving grounds and to the Office of the Chief of Ordnance in Washington.

The Office of Ordnance Research will evaluate projects in the field of basic scientific research and award contracts according to these classifications:

1. Their relation to general fields in which ordnance applied research and development problems have been frequently encountered.

2. Relation to possible radically new design principles for ordnance devices.

3. Relation to unique ordnance facilities and skills, such as the use of ordnance guided missiles for high-altitude research.

4. Relation to significant frontier areas of science where results are likely to affect all human affairs, including warfare.

The establishment of the center at Duke University, Durham, N. C., puts into action Ordnance's expanded basic research program. The staff will eventually be comprised of about forty persons—fifteen scientists and twenty-five technical and administrative personnel.

Universities, colleges, and research institutions over the Nation have been invited to submit proposals for research projects to the office. The projects will be integrated into the various institutions' research programs and will be used in training graduate research students.

It is hoped to build up a corps of young scientists throughout the United States with a knowledge and appreciation of the technological problems of Ordnance.

The scientists at the various institutions who receive contracts will themselves carry out the planning and execution of the investigations, but there will be close liaison between the scientists at Duke and the investigators.

Army Ordnance will supply researchers with background information about ordnance problems and special techniques in their various fields.

Col. Walker W. Holler, a native of Cornwell, S.C., has been named commanding officer of the newly established Office of Ordnance Research. He was formerly ordnance officer of the Third Army, Fort McPherson, Ga.

Prior to World War II, he served in Hawaii, at Aberdeen Proving Ground, Md., at Picatinny Arsenal, N.J., and as an instructor of ordnance and gunnery at the U.S. Military Academy at West Point.

Security with Economy

An Editorial

ACCORDING to reliable estimates, the approximate funds available on September 15, 1951, for future national-defense spending totaled $103,800,000,000. The breakdown is: Army $41,100,000,000; Navy $22,500,000,000; Air Force $34,800,000,000; and the Secretary of Defense $5,400,000,000.

These figures do not include the $5.8 billion recently voted for military construction, the $6 billion voted for the North Atlantic Treaty Organization program. The bill for the Korean War, which has already reached an estimated $7.5 billion is included!

These stratospheric costs are as serious for our national survival as the threat of war itself. They must be reduced drastically else we shall perish at home in our own hysterical rush to save ourselves abroad.

Some brave attempts have thus far been made in the direction of economy, but over all they seem feeble. Thus an amendment was adopted for the Defense Appropriation Bill which puts a ceiling of 500,000 on the number of civilian employees in the military establishment. Another amendment was adopted which would prevent the schooling as well as the "stock-piling" of stenographers! The huge pie of Government spending for defense is nibbled at on the economy edges, but, while some steps are most commendable, the cost is still far too great. In the opinion of many students, the total cost must be reduced soon by half!

Representatives of the Army, Navy, and Air Force have pointed out that both inflation and the increased complexity of modern arms and equipment have swollen the Nation's rearmament costs. One example was a $250,000 radar bombsight replacement for the $8,000 model that served as its counterpart in World War II. Combat boots have jumped in price from $6.20 to $11.63 a pair.

A few years ago a certain type of high-explosive 105-mm. shell cost $12.39; today's cost is $29.59. Even in the past year the cost of Army flashlights jumped 32.7 per cent, and Army portable power units have gone up 15 per cent.

The Navy has to contend with such recent price rises as a 143 per cent jump in the cost of blankets, 114 per cent for 5-inch shell cases, and 38 per cent in gun fire-control systems.

Commendable Efforts Made

Some commendable efforts are being made ordnancewise in both Army and Navy to maintain the defense structure and to protect the interests of that forgotten man—the American taxpayer. The savings effected by the Army's rebuild program since World War II are an excellent case in point. These savings can now be measured in terms of billions of dollars.

Although major contributions have been made by the Engineers, Quartermaster, Signal Corps, and the Army's other technical services, the most spectacular economies, dollarwise, are to be found in the Army Ordnance efforts in this field.

In the United States, the Ordnance rebuild program has been turning out rebuilt equipment since World War II as needed and as funds were available. The rebuild of this equipment in most cases required complete stripping, repair, and reassembly of all component parts, testing, and acceptance before shipment. Both the demand and the funds for these operations increased markedly after June 1950.

Many Items Rebuilt

Based on initial World War II procurement costs, more than $1,675,000,000 worth of ordnance principal items of matériel have been rebuilt during the period July 1, 1947, to June 30, 1951, and returned to the supply system, which includes supply to other countries. This rebuild cost, including spare parts, amounted to approximately $475,500,000.

In the Far East, the cost to replace only those vehicles which were shipped from the Pacific islands to Japan and rebuilt there is estimated at over one billion dollars. The Far East rebuild program, begun in 1948, was stepped up with the advent of Korean operations and is still in high gear and has already provided 50,000 general-purpose trucks, 713,000 small-arms weapons, and 705,000 tires and tubes for the use of United Nations forces in Korea. The availability of such equipment, produced by the rebuild program in the early months of the Korean war before shipments could arrive from the U. S., was of obviously critical importance in blocking the Communists.

But despite inflated values and the growing complexity of combat equipment, tremendous additional savings are not only possible but are urgently demanded because of the terrific strain that present expenditures of $103.8 billion puts on our entire national economy. American military strength cannot be divorced from our national economic strength. The permanence of both is essential to national survival.

We are not suggesting that the ordnance services of the Army, Navy, and Air Force are the only economy-minded units in the armed services. What must be cried from the housetops day in and day out is that all military and civilian segments of the national-defense effort tighten their belts and redouble their war on waste, extravagance (frequently it cries to high heaven!), duplication of effort and facilities, bureaucratic paper-shuffling, unnecessary requisitions, personnel "stock-piling," and similar zany prodigalities at the expense of the already overburdened taxpayer.

Adequate armament in the hands of a bankrupt nation is certainly not the answer to the Communist challenge. America must be militarily, economically, and morally strong in order to provide effective leadership in the serious crisis now confronting all mankind. In this struggle, the year 1952 should see us over the hump in dollar spending for national defense.

The United States Atomic Energy Commission

whose paramount objective is

to assure the common defense and security

will be acclaimed

and the Commission's Chairman

MR. GORDON DEAN

will be the principal speaker

at the

Annual Industrial Mobilization Dinner Meeting

under the auspices of the New York Post of the Association

to be held

at the Waldorf-Astoria, New York City

Wednesday, December 5, 1951, at 7:30 p.m.

Complete details and reservation forms have
been sent to all members of the Association

ASSOCIATION AFFAIRS

• **AT NEW YORK.**—Announcement is made elsewhere in this issue of the forthcoming annual Industrial Preparedness Dinner Meeting of the Association to be held at the Waldorf-Astoria, New York City, on the evening of Wednesday, December 5, 1951. In accordance with long-standing custom, the meeting will be under the auspices of the New York Post, of which Vice Adm. George F. Hussey, Jr., U.S.N., Ret., is president.

The meeting this year will be in tribute to the United States Atomic Energy Commission whose motto is "To assure the common defense and security." Gordon Dean, Chairman of the Commission, will be the principal speaker, and it is hoped that the entire membership of the Commission will also be in attendance. The members of the Commission are: Mr. Dean, chairman; T. Keith Glennan, Thomas E. Murray, Sumner T. Pike, and H. D. Smith.

Invitations to the meeting were sent to the entire membership of the Association on November 1st. Due to the great popularity of these New York meetings it is suggested that members send in their reservations promptly. Places will be assigned in the order of their receipt. In the case of the Thirty-Third Annual Meeting of the Association at Cincinnati on October 4th, the capacity of the ballroom was 1,800 places—all of which were reserved 10 days before the closing date. For that meeting more than 300 reservations were returned to members for lack of accommodation. We urge members who plan to attend the Waldorf meeting on December 5th not to delay!

• **AT CINCINNATI.**—Forms for this issue of ORDNANCE magazine were held to include an account of the Thirty-Third Annual Meeting of the Association at Cincinnati on October 4th and at Wright-Patterson Air Force Base, Dayton, Ohio, on October 5th. A pictorial story of the meeting appears on pages 406-411.

The program of demonstrations and tests arranged by the Air Force under the guidance of Lieut. Gen. E. W. Rawlings, commanding general of Wright-Patterson Air Force Base, surpassed any similar aircraft armament program heretofore presented before a technical society.

C. E. Wilson, president of General Motors Corporation, Detroit, was the honor guest and principal speaker at the dinner meeting in Cincinnati on October 4th. Mr. Wilson was awarded the Charles L. Harrison Gold Medal for Distinguished Ordnance Service which is presented annually by the Cincinnati Post. More than 1,800 members and guests attended the dinner meeting at which Louis Polk, president of the Cincinnati Post, presided and James L. Walsh, president of the American Ordnance Association, acted as toastmaster.

The committee on award of the Cincinnati Post which was in charge of the presentation of the Harrison Medal to Mr. Wilson consisted of Frederick V. Geier, president of the Cincinnati Milling Machine Company, and Harvey C. Knowles, vice-president of Procter & Gamble Company, Cincinnati, and vice-president of the A.O.A.

Mr. Wilson's address, "Preparedness as a Continuing Policy," will be published in full in the next issue of ORDNANCE magazine as also will the technical papers which were presented at the aircraft armament session by leading armament authorities of the Army, Navy, and Air Force as follows:

"Status of Aircraft Armament," by Brig. Gen. Gordon A. Blake, U.S.A.F., chief, Weapons Components Division, Wright Air Development Center, Dayton, Ohio;

"Material for Airborne Equipment," by Col. B. S. Mesick, Ordnance Corps, U. S. A., commanding officer, Watertown Arsenal, Watertown, Mass.;

"Rockets," by Comdr. W. H. Keighly, U.S.N., head, Rockets Section, Research and Development Division, Navy Bureau of Ordnance, Washington, D. C.;

"Automatic Weapons," by Col. René R. Studler, Ordnance Corps, U.S.A., chief, Small Arms Branch, Ordnance Research and Development Division, Office of the Chief of Army Ordnance, Washington, D. C.;

"Aircraft Fire Control," by Col. John F. Babcock, U.S.A.F., chief, Armament Division, Office of Director of Research and Development, U. S. Air Force, Washington, D. C.;

"Antisubmarine Weapons," by Capt. H. P. Cooper, U.S.N., program director for aviation ordnance, Planning and Progress Division, Navy Bureau of Ordnance, Washington, D. C.

• **AT WASHINGTON.**—The Association's Life Membership Committee under the chairmanship of Col. John S. Pfeil is conducting a nationwide campaign to increase the roster of A.O.A. life members. The personnel of the committee in addition to Colonel Pfeil is: R. Stanley Dollar, the Robert Dollar Company, San Francisco, Calif.; Thomas H. Eddy, George A. Kelly Company, Pittsburgh, Pa.; B. T. McNeil, McEvoy Company, Houston, Tex.; Walter F. Rockwell, the Timken-Detroit Axle Company, Detroit, Mich.

Colonel Pfeil, in addition to being a vice-president of Stone & Webster, Inc., Boston, is also civilian chief of the Boston Ordnance District. Colonel Eddy is president of the Pittsburgh Post of the Ordnance Association.

The roster of life members, which now numbers 678, is being prepared for publication in an attractive booklet. As of November 1, 1951, it will contain the names of all life members and medalists of the Association who have been enrolled during the past thirty-three years.

A new life member pin—the A.O.A. insigne on a field of blue is now being made and will shortly be sent to all enrolled life members. Many regular annual members are converting their membership to the life category, thus indicating the permanence of their allegiance to the Ordnance fraternity. The life membership committee will gladly send the necessary applications to all members who wish to have their names added to the permanent life member roster.

• **AT DETROIT.**—Maj. Gen. Clark L. Ruffner, U. S. Army, who commanded the 2nd Infantry Division in Korea, was the principal speaker at the father-and-son meeting sponsored by the Michigan Post of the American Ordnance Association on September 20, 1951. The meeting was held at the Detroit Tank Arsenal, Center Line, Mich., of which Col. G. C. Wilhide is commanding officer. Brig. Gen. Emerson L. Cummings, chief of the Industrial Service of Army Ordnance, was among the special guests.

The program under the direction of Colonel Wilhide and his staff afforded an opportunity for the fathers and sons of the Michigan Post to join in conducted tours through the mammoth tank

arsenal. Visitors saw the famous General Patton tanks in production as well as the rehabilitation and rebuilding of "mothballed" tanks.

Of special interest was a display of captured Russian-made guns, equipment, and matériel from the Korean war. American-made wheeled and tracked vehicles were also exhibited.

General Ruffner's address brought home to all present the importance of superior ordnance equipment. He gave firsthand information from the Korean war. Shortly before his return to the United States he accepted the Presidential Unit Citation of the 2nd Infantry Division for heroic conduct in battle near Hongchon during the period May 16-22, 1951. This is the Nation's highest unit award.

More than 1,100 members and guests of the Michigan Post attended the function which was adjudged one of the most interesting and timely in the history of the organization.

The Post has an active membership committee under the chairmanship of Henry J. Sullivan. The organization now has the largest membership roster in its history. The committee is composed of: William F. Anderson, General Motors Corporation; William J. Athanson, Briggs Manufacturing Company; Glenn M. Brown, Ryerson and Haynes, Inc.; John L. Brown, Jr., assistant to vice-president, Nash-Kelvinator Corporation; Robert J. Brown, Hapman-Dutton Company; Thomas C. Couper, L. A. Young Spring & Wire Company; Thomas C. Downer, Oldsmobile Division, General Motors Corporation; James Fulks, Ex-Cell-O Corporation; Britton L. Gordon, Blackmer Pump Company; and Richard Krafve, Ford Motor Company.

• **AT LOS ANGELES.**—The Los Angeles Post, under the able leadership of William A. Wilson, newly elected Post president, was welcomed by the Navy on a visit to the Amphibious Training Base on the Coronado Strand, just across the Bay from San Diego, Calif.

Eighty members of the Post, together with a number of guests, witnessed a very extensive amphibious landing training operation in which amphibious vehicles of all descriptions, from "Alligators" to LST's and LSM's "hit the beach" in nine successive waves.

Prior to the actual landings, a demonstration of underwater demolition was put on, using small boats, rubber rafts, and husky swimmers. During the landing operations, the beach was "strafed" at a low level by a squad of Navy jet F-84 fighters.

During the complete operations a most interesting running commentary was given by means of a public-address system so that Association members and guests were fully aware at all times of the actions of all the groups involved in the landing operations.

After a well-prepared luncheon in the officers' mess at the base, a sand-table demonstration was put on, using a most elaborate collection of scale models of all the equipment used during the morning's operation on a scale model of the beach. A lecture was given concurrently with the sand-table demonstration to illustrate the tremendous amount of planning and detailed coördination that goes to make such a landing operation a success.

The sand table was complete with roads, trees, houses, bridges, sea area, etc., and the demonstration consisted of accurately placed moving models of destroyers, submarines, LST's, and landing craft of all types, with model airplanes flying overhead and simulated explosions of miniature mines, bombs, and artillery weapons.

The very interesting morning's activities were also witnessed by members of the Navy League. The afternoon demonstrations were witnessed by several companies of Marines and Army units which were completing a training course at the base in amphibious operations and were scheduled to leave the United States immediately for duties in Korea.

The Los Angeles Post is deeply indebted to the commanding officer of the Eleventh Naval District and to the commandant of the Amphibious Training Base and their staffs who helped make this such an outstanding Post activtiy.

• **AT MAXWELL FIELD.**—Gen. George Kenney, a veteran of both World Wars, recently retired from the Air Force.

Always popular with the Ordnance fraternity and a guest speaker at many Ordnance functions, General Kenney had a distinguished aviation career, culminating in his energetic prosecution of the air war against the Japanese in the Southwest Pacific a few years ago.

This outstanding American military leader merits the lasting gratitude of the entire Nation for his many years of devoted and unselfish service to the cause of human freedom.

General Kenney was born at Yarmouth, Nova Scotia, on August 6, 1889. He attended Massachusetts Institute of Technology at Cambridge for three years.

At the outbreak of World War I, he enlisted as a flying cadet in the Aviation Section of the Signal Reserve, and after completing the course he was commissioned a temporary first lieutenant in the Aviation Section.

His first commissioned service was with the 14th Foreign Detachment, with which he sailed for France in November 1917. After completing a course in advanced flying in France, he was assigned to the 91st Aëro Squadron in February 1918 and was on duty with this organization for the ensuing sixteen months. In this service, Lieutenant Kenney accumulated more than 110 hours of flying over the front lines of the Toul and Meuse-Argonne sectors, and engaged in twelve combats. He was credited with the destruction in aërial combat of two enemy aircraft.

In 1939 General Kenney became chief of production at Wright Field, Ohio. The following year he served as Assistant Attaché for Air in Paris, observing tactical operations on the Franco-German front and studying technical developments made in military aircraft and equipment by both sides. As a result of his observations, a large number of improvements were made in our military aircraft prior to our actual entry into World War II.

In March 1942, he went to the West Coast to assume command of the Fourth Air Force, and in July of that year he assumed command of Allied Air Forces in the Southwest Pacific, and also of the Fifth Air Force. In June 1944, in addition to his Allied Air Command, he was given command of the Far East Air Forces which combined the Fifth and Thirteenth Air Forces.

Under General of the Army Douglas MacArthur, he directed the successful air war against the Japanese for more than three years through the Southwest Pacific theater from Australia to the Philippines.

In December 1945, General Kenney was assigned to temporary duty with the Military Staff Committee, Joint Chiefs of Staff, Washington, D. C., and was sent to London for the duration of the United Nations Conference. He continued temporary duty with the Military Staff Committee when they moved to New York in March 1946.

In April 1946, he was designated commanding general of the Strategic Air Command, with headquarters at Andrews Air Force Base, Md. On October 15, 1948, he assumed command of the Air University at Maxwell Air Force Base.

• **AT WASHINGTON.**—The Department of the Navy has produced and distributed "Navy and Science," a 12-minute black-and-white public-information film which is now available for public nonprofit and television screenings.

Highlighted in the film are the many important scientific research programs being conducted by the Navy to benefit free people everywhere.

Several of these vital experiments, being sponsored by the Office of Naval Research in more than 200 universities throughout the country, are depicted including laboratory tests with germ-free

animals; discovering hitherto unknown properties of metals by subjecting them to extremely high or low temperatures; the study of the vast and mysterious atmosphere which surrounds the sun; the use of high-altitude rockets to obtain cosmic-ray data so necessary for atomic research; and tests to determine the effects of spinning and turning on human beings and applying the results to aviation and pilot training.

By probing into the innermost secrets of nature, the Navy continues to improve on techniques, develop advanced scientific equipment, and save more lives. In time of peace as well as in time of war, this extensive program plays an important part in keeping our Navy foremost and our country strong.

This film is suitable for high school age groups and above. Prints may be borrowed on a loan basis from the Assistants for Information of the nearest Naval District. Prints (16-mm.) may be purchased from United World Films, Inc., 1445 Park Avenue, New York, N. Y., the contractual agency for the U. S. Office of Education.

• **AT WHITE OAK.**—The Secretary of the Navy recently presented the Distinguished Civilian Service Award to Dr. Edward A. Gaugler for services outlined in the following citation:

"For distinguished service to the United States Navy while serving as chief of the Magnetic Materials Subdivision of the Naval Ordnance Laboratory, White Oak, in developing and perfecting techniques for the production of magnetic materials, which had previously not been produced in this country, for overcoming almost insurmountable difficulties in directing a program which identified magnetic properties, developed annealing techniques, and culminated in a new and far superior material, 'Orthonol,' a vital component of many types of existing and new naval equipment, thereby completely eliminating critical manufacturing problems and enabling commercial manufacture to proceed on a production basis.

"By these major contributions in the field of magnetic alloys, Dr. Gaugler has distinguished himself in a manner richly deserving of the Navy's highest civilian award."

• **AT FRANKFORD ARSENAL.**—On August 20th, at a special ceremony at Frankford Arsenal, Philadelphia, Pa., in the presence of civilian and military members of the arsenal staff, Harry A. Evangelides was the surprised recipient of an Exceptional Civilian Service Gold Medal Award. The presentation was made by Col. Ward E. Becker, commanding officer of the arsenal, in behalf of Secretary of the Army Frank Pace, Jr., and the Chief of Ordnance, Maj. Gen. E. L. Ford.

• The complete proceedings of the Thirty-Third Annual Meeting of the American Ordnance Association, held in Cincinnati, Ohio, on October 4, 1951, will be published in the January-February 1952 issue of ORDNANCE.

The proceedings will include the address of C. E. Wilson, president of General Motors Corporation, the principal speaker at the Thirty-Third Annual Dinner, as well as the technical papers given at the aircraft armament session by outstanding ordnance authorities of the Army, Navy, and Air Force.

Mr. Evangelides received a gold medal, lapel pin, and a certificate for exceptional performance of duty as a chemical engineer at the Pitman-Dunn Laboratories of the arsenal from July 19, 1948, to March 1951. His alertness in detecting the significance of the rôle played by certain metals in the formation of electrolytic coating on magnesium surfaces led to the development known as the HAE process, named after the discoverer's initials. This outstanding process, arrived at after extraordinary laboratory research and application, is of great importance to the magnesium industry and is a real contribution to the defense effort of this country.

Other participants in the ceremony were: Dr. Herschel Smith, Research and Development Assistant; C. C. Fawcett, director, Pitman-Dunn Laboratories Department; Lieut. Col. D. J. Murphy, chief, Pitman-Dunn Laboratories Department; and Max Frager, head, Protective Engineering Research Branch, Pitman-Dunn Laboratories Department.

• **STANDARDS FOR DEFENSE.**—As this issue went to press, 400 members of the American Ordnance Association were expected to attend the "Industrial Standards for Defense" session of the Second National Standardization Conference scheduled in the Waldorf-Astoria Hotel, New York, on October 22nd.

The Ordnance Association sponsored the session, at which Louis Polk, vice-president of the Association and president of the Sheffield Corporation, Dayton, Ohio, was to serve as moderator.

Other speakers at the session were to be K. H. Condit, dean of the School of Engineering, Princeton University; William C. Newberg, president, Dodge Division, Chrysler Corporation, Detroit; and R. C. Sogge, General Electric Company, Schenectady.

Scheduled to participate in the panel discussion following the addresses were Brig. Gen. Merle H. Davis, chief of the Ammunition Branch, Office of the Chief of Army Ordnance, Washington, D. C.; Donald A. Quarles, vice-president, Bell Telephone Laboratories, Inc., New York, N. Y.; Dale Roeder, executive engineer, Ford Motor Company, Dearborn, Mich.; Rear Adm. M. F. Schoeffel, Chief of the Navy Bureau of Ordnance, Washington, D. C.; and James L. Walsh, president of the American Ordnance Association, Washington, D. C.

Announcement of the speakers was made by Vice Adm. George F. Hussey, Jr., U.S.N., Ret., who was wartime Chief of the Navy Bureau of Ordnance.

"We are now engaged in a bold experiment," Admiral Hussey declared, "that no nation, including ours, has ever before dared to try. We are attempting to rearm ourselves and our allies and yet to maintain and eventually improve our production of goods for civilian use.

"National standards are one key to the success of this program. Lack of standards has cost the country incredibly heavy losses in the past decade in war and, postwar, in peace and in rearmament. If we are to carry out our present ambitious program successfully, we must not continue to lose production and waste materials, manpower, and money because of lack of adequate national standards."

• **JOHN D. PEDERSEN** died on May 23, 1951. His death removed from the ranks of American arms inventors a talented engineer whose researches in the field of small-arms development have had a wide and beneficial effect on American arms progress. Mr. Pedersen died at Sedona, Ariz., while on vacation. He was long a resident of Springfield, Mass., and since his retirement from active participation in his chosen profession he had lived at Blandford, Mass.

One of the greatest achievements of this ingenious artisan was the Pedersen Device which, under great secrecy, was developed during the first World War and was of wide significance in the trench warfare stalemate of those days. It was an automatic bolt for use on the standard Springfield rifle which converted the Springfield to a 40-shot semi-automatic repeating rifle. It was designed to use a caliber .30 pistol-type cartridge fed from a 40-shot magazine.

Writing of the Pedersen Device in the May-June 1933 issue of this magazine, Maj. Gen. J. S. Hatcher described it as a "small attachment to the soldier's Springfield rifle which virtually converted the rifle into a miniature machine gun capable of delivering a whirlwind of rapid fire instead of intermittent shots."

Designed originally for use on the Model 1903 Springfield, it was further developed to fit the Model 1917 rifle also. The first order for 100,000 of the devices was placed with the Remington Arms Company in March 1918 and subsequently increased to 133,450. These remained in storage for twelve years following the first World War and gave place when real progress was made both by Mr. Pedersen and other engineers in the development of a semiautomatic shoulder rifle of full power and accuracy.

It was in this latter field also that Mr. Pedersen contributed greatly to our American leadership of all the rest of the world in the advancement of automatic arms. In 1927 Mr. Pedersen was engaged by the Chief of Ordnance of the Army as a design engineer for the purpose of developing and producing a semiautomatic shoulder rifle for the Army. This he did with unusual speed. He originated the Pedersen rifle of caliber .276 which was tested successfully and finally recommended for adoption by the Army. It was not finally approved, however, because it involved a change in caliber from the standard American .30. This wise decision was made personally by Gen. Douglas MacArthur, then Chief of Staff of the Army. As a result, the caliber .30 remained standard, and subsequently the Garand semiautomatic rifle was adopted.

In addition, Mr. Pedersen had done outstanding work as an arms designer in the commercial field which brought him great and well-deserved recognition. Many of the Remington Arms best known pieces were the result of his fine engineering talents. These included the Remington Model 1910 repeating shotgun; the Remington slide-action .22 repeating rifle, Model 12; the Remington slide-action high-power repeating rifle, Model 14; and the Remington automatic pistol, Model 51.

During recent years Mr. Pedersen had been living more or less in retirement at Blandford. There he was constantly in touch with his many friends in the Ordnance fraternity for whom his death marks the passing of a truly great arms designer and engineer.

• **SAMUEL FELTMAN.**—Army Ordnance announced on September 6, 1951, the tragic death on that date of Samuel Feltman, one of its leading engineers and ballisticians. He and his wife and father-in-law were killed in an automobile accident near Albany, N. Y., while on a vacation trip to Canada. The Ordnance announcement, prepared by Col. J. A. Barclay, Ord. Corps, continues:

Mr. Feltman, an outstanding authority on ballistics, was born at Long Branch, N. J., in 1899 and attended school there. He entered the service of the Ordnance Corps at Sandy Hook Proving Ground in February 1918. In September 1919 he was assigned to duty at Aberdeen Proving Ground where he was in charge of the gunnery section until 1929, at which time he came to Washington as assistant to the chief engineer, Ammunition Division, Technical Staff. In 1941 he became chief of the ballistic section of the newly formed Technical Division.

At the time of his death he was serving as associate chief of the Research and Materials Branch and chief of the ballistic section of the Ordnance Research and Development Division. In this capacity he exercised technical and administrative control over the programs of research into interior, exterior, and terminal ballistics; coördinated the activities of research in metals, plastics, glass, fibers, fuels, lubricants; atomic application to Army use and other fundamental research programs; and served as consultant to all divisions of the Ordnance Corps, outside agencies, and field installations.

His accomplishments and contributions in the field of interior, exterior, and terminal ballistics are recognized not only in this country but in allied nations, which he visited on several occasions as a representative of the Ordnance Corps. Mr. Feltman proposed the ballistic characteristics of such weapons as the 90-mm. and 120-mm. antiaircraft guns, the 8-inch gun, the 240-mm. howitzer, and many other weapons which constitute the major part of our fighting equipment. In fact, he participated in the design of most of the new weapons and new rounds of ammunition produced by the Ordnance Corps in the past twenty years.

The success of the design and development of high-speed electronic computers, in which the Ordnance Corps pioneered and from which the ENIAC and EDVAC have culminated, is attributable in great measure to his foresight and active support. He also contributed immeasurably to the conception and successful development of the hypersonic wind tunnel having air flow speeds ten times the velocity of sound.

In 1944 he was awarded the Emblem for Meritorious Civilian Service, upon completion of 25 years of faithful and satisfactory service. In 1945 he was awarded the Emblem for Exceptional Civilian Service, the highest award which can be bestowed upon a civilian by the Army, for, as the citation accompanying the award stated, "many years of exceptional service in the field of ballistics; for notable improvements in the theory, technique, and instrumentation by which ballistic data are obtained; for providing the accurate firing tables which direct American shells to their targets and the bombing tables which make our air raids so effective; for coördinating the forward-looking studies of the Ballistic Research Laboratories with the urgent needs of the current war; and for outstanding contributions to the design, development, and accuracy of American weapons, which have played a large part in making them the finest in the world."

He worked far beyond the call of duty to make it possible for our soldiers in the field to have the best and most efficient equipment.

• **R. M. KANT,** president and chairman of the board of the Hamilton Watch Company, died July 29th at Atlantic City, N. J. His spectacular career from errand boy to the presidency of his great company was indicative of the energy and zeal to which he devoted his talents.

Mr. Kant was born in Lancaster, Pa., in 1902 and attended Franklin and Marshall College. Last year, thirty years later, he returned to his alma mater to receive the honorary degree of doctor of commercial science. While still in high school, Mr. Kant worked at the Hamilton Watch Company as errand boy, machine operator, and manager in the escapement department. Thereafter he served successfully in many important positions for the company, becoming president in 1948.

During his brief administration as company president he supervised the planning of the company's new research and engineering laboratory and auxiliary plant now under construction to expand the company's facilities for processing defense production.

• **WILBUR JUDSON,** senior vice-president of Texas Gulf Sulphur Company and long a member of the American Ordnance Association, died on August 9, 1951. His company and many of its officials through the years have been ardent supporters of industrial preparedness through the work of the Ordnance Association.

Mr. Judson was a native of Michigan. He attended Northwestern University, University of Michigan, and was graduated from Harvard University in 1901. He began his engineering practice in the Argentine, Mexico, and Colorado. Since 1926 he had served as a vice-president and director of the Texas Gulf Sulphur Company and vice-president and director of the Sulphur Export Corporation. He was also a director of the Mesabi Iron Company and of the Great Plains Development Company of Canada, Ltd.

Mr. Judson had rendered outstanding service to the United States in several capacities connected with the national-defense program.

His loss is especially great at this time when the operations of his company and its production are of such vital importance to the defense program.

How to keep water off a duck's back

(even when its feet get wet)

It's known as the work horse of the service! In fair weather or foul . . . rolling across country, or ploughing through a heavy sea . . . the duck has earned a reputation for dependable performance!

That's because these babies are built to take combat punishment . . . from the sturdy chassis, to the flawless Conmar zippers on the tarp covers.

Conmar zippers are precision-engineered and quality-constructed to work perfectly under any conditions. Conmar's slide freely, easily, instantly. They're rust-proof, mildew-resistant, water-repellent for smooth performance in any weather, too.

You can load a duck's compartment till the canvas groans and bulges . . . no worry about a Conmar standing up under heavy cross-pull strain! It's built for it!

There's a flawless Conmar zipper for every closure situation. When ordering zippers under QM-100-31, AN-229, or VF-106, call any of the Conmar offices listed below. They're ready to help you.

Conmar zippers

Conmar, Newark 1, N. J. Direct N. Y. Phone: REctor 2-9800
BRANCHES: Atlanta · Baltimore · Boston · Chicago
Cincinnati · Cleveland · Dallas · Los Angeles · Minneapolis
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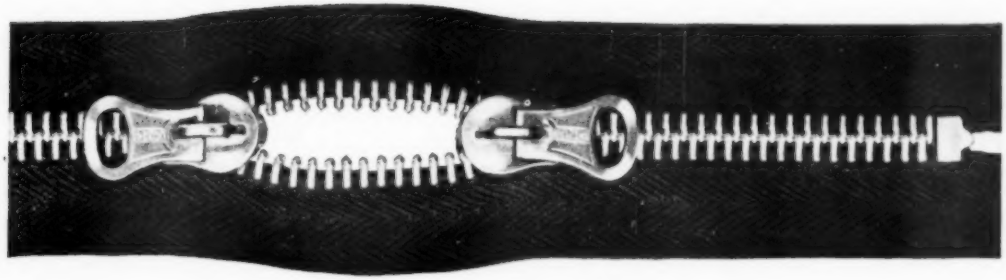

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PROTECTS ALUMINUM
ANCHORS THE PAINT FINISH

MEETS GOVERNMENT SPECIFICATIONS

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MIL-S-5002	16E4 (Ships)
AN-F-20	U.S.A. 72-53 (See AN-F-20)
AN-C-170 (See MIL-C-5541)	

EFFECTIVE, ECONOMICAL EFFICIENT

ALODIZING is an electroless protective surface conversion process for bonding paint to aluminum and protecting the metal.

Tough, durable ALODIZED surfaces are obtained easily and rapidly by immersion, brushing, or spraying in a multi-stage power washer.

ALODINE amorphous phosphate coatings provide extra paint permanence and extra durability for aluminum parts and products.

BRUSH "ALODINE" PROTECTS ALUMINUM IN THE FIELD, SHOP, OR HANGAR

Brush ALODINE is easily applied in a simple brush-on or flow coat process to large assemblies and surfaces—airplanes, trucks, trailers, boats, housing, building siding, railway cars, bridges, etc.—that are too bulky or too remote to be conveniently treated in tanks or a multi-stage power spray washer. The cleaning and coating chemicals for Brush ALODIZING are shipped in bulk or in the convenient Brush ALODINE Chemical Kit No. 1. This Kit contains enough chemicals to treat about 1,000 square feet of surface and is an ideal package for use at airfields of commercial airlines or of the Armed Services anywhere.

Pioneering Research and Development Since 1914

AMERICAN CHEMICAL PAINT COMPANY

AMBLER, PA.

Manufacturers of Metallurgical, Agricultural and Pharmaceutical Chemicals

NEW DEVELOPMENTS

VERSATILE BATTERY

A lightweight storage battery which will start a car at 65 degrees below zero or at 165 above has been developed at the University of Michigan Engineering Research Institute under the sponsorship of the United States Army Ordnance Corps. The new battery was made possible by successfully lead-plating materials ordinarily corroded by sulphuric acid. This makes it possible to replace large amounts of the lead used in standard batteries with aluminum, brass, iron, or copper. The use of these materials results in a much lighter yet more powerful battery.

PILOTLESS BOMBER SQUADRON

The United States Air Force has activated the 1st Pilotless Bomber Squadron (Light) at the USAF Missile Test Center, Cocoa, Fla. It is the first operational

The Matador B-61 pilotless bomber.

unit of its kind in the Air Force. The unit will be equipped initially with the new Matador B-61 pilotless bomber, now in production by the Glenn L. Martin Company of Baltimore, Md. The squadron is supervised in its initial training by an already established training unit, the 6555th Guided Missile Wing, a part of the Air Research and Development Command. Later, it will be made combat-ready by extensive unit training under the supervision of the Tactical Air Command.

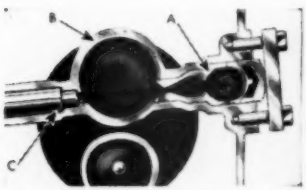
PLASTIC TARPAULINS

Vinyl chloride plastic shrouds developed by Army Ordnance will replace canvas tarps, wooden boxes, and crates in protecting shipments of ordnance materiel and for outdoor storage. The shrouds will be made in 50 different sizes, can withstand 60-mile-an-hour winds, and have a temperature range from subzero to more than 95 degrees. Cheaper than canvas and wood, plastics are also lighter and easier to handle, a shroud large enough for a 20,000-pound machine weighing about 30 pounds.

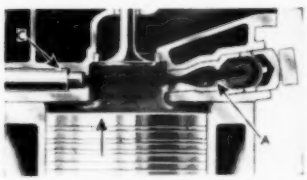
(Continued on p. 428)

CONTINENTAL MOTORS
Powerful as the Nation
AMERICA'S STANDARD

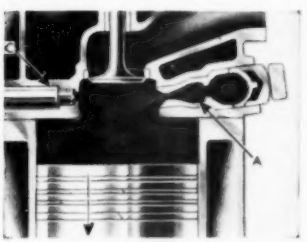
Here's the "Inside Story" of
CONTINENTAL CUSHIONED POWER



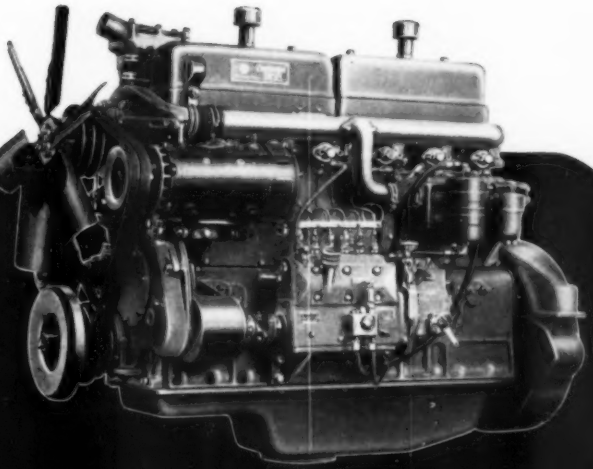
Top view of combustion chamber, showing Dyna-Cell (A), turbulence chamber (B) and nozzle (C). A definite portion of fuel charge from nozzle enters Dyna-Cell.



Fuel charge is self-ignited by pressure just before piston reaches top of compression stroke. But pressure developed by the fuel within the Dyna-Cell is absorbed momentarily by the latter . . . .



. . . to be released through metered opening during the piston's downstroke. Thus, peak pressures are converted into useful "follow-through" power.



Model RD-6572—Transportation Diesel, 6-cylinder, 4¾" bore x 5⅜ stroke, 572 cubic inch displacement. Develops 150 h.p. at 2200 r.p.m.

RED SEAL CUSHIONED POWER DIESELS COST LESS TO RUN AND TO MAINTAIN

Continental Cushioned Power Combustion Chamber with Dyna-Cell (see diagrams at left) not only gets ALL the power from the fuel, but smooths and prolongs the power impulse, preventing the development of destructive peak pressures usual in engines of Diesel type. This avoidance of extreme pressures lengthens engine life. It speeds and simplifies service, by permitting wide interchangeability of parts between Red Seal Diesel and gasoline models. Moreover, the weight-to-horsepower ratio is unusually favorable, a consideration of great importance in many applications. Choose Continental Cushioned Power Diesels for lower costs . . . longer useful life.

REMEMBER, GOOD EQUIPMENT IS BETTER WITH CONTINENTAL RED SEAL POWER

Continental Motors Corporation
MUSKEGON, MICHIGAN

the Underwood Sundstrand
***automatic* Printing Calculator!**

Looks like only *one* machine!

But this new Underwood Sundstrand Automatic *Printing* Calculator is *really two different machines in one!*

With many advantages for both large and small businesses.

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Jobs...from payrolls to inventories. From computing interest to figuring statistical calculations.

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Only 10 numeral keys...*touch-operated* to speed the work...cut tiresome headswing and attendant errors.

Get full information about this important new feature-packed two-in-one machine.

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Please send me your folder on the new Underwood Sundstrand Automatic Printing Calculator.

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New Developments

HOTFOOT FOR MARINES

Thermos boots for the Marines in Korea, tested at 45 degrees below zero, should eliminate the frostbite which claimed so many victims in the wet-cold of last winter. Actual tests of the sealed insulation rubber boots, with water frozen in the boots and wearers donning frozen socks, showed that ice melted in eight minutes and feet stayed warm thereafter. So long as a man moves once an hour to keep circulation normal, Marines say the new boots will prevent trench foot.

NEW INFANTRY CARRIER

The Army has a new vehicle designed to get soldiers to the front lines without their being hurt by small-arms fire or shell fragments. It is a full-tracked, armored infantry carrier, officially designated the T18E1, developed by the Ordnance Corps and intended to carry a 12-man squad.

The T18E1 will carry a 12-man squad.

The carrier will take infantrymen anywhere that tanks can go, giving them a chance to act as spearheads. It weighs 20 tons, can go 35 miles an hour on good roads, can turn in its own length, and can climb or go down 60-degree slopes.

Armed with a caliber .50 machine gun, the carrier is powered with Ordnance's newest 6-cylinder, air-cooled engine and cross-drive transmission. Compared to its forerunners, it is better armored overhead, easier to operate, faster and more maneuverable.

"FLYING DISKS"

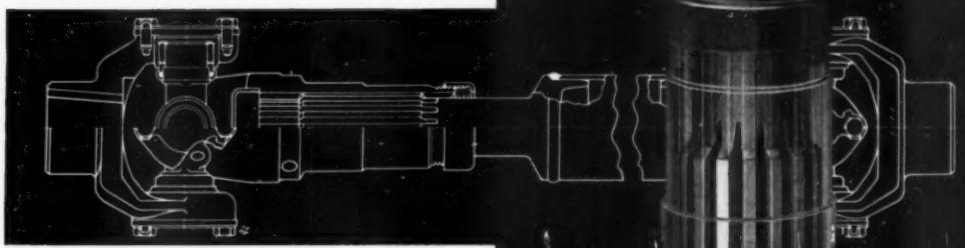
A synthetic rubber disk shaped like an inflated pancake is being tested by the Army as a means of dropping liquids to ground troops from distances ranging from 400 to 2,000 feet in the air. This newly developed container is twenty-four inches in diameter when empty, weighs five pounds, and has a top capacity of five gallons. A flat rim circles its perimeter when the container is filled. It can be dropped from any type of cargo aircraft, and no parachute is needed to check its fall.

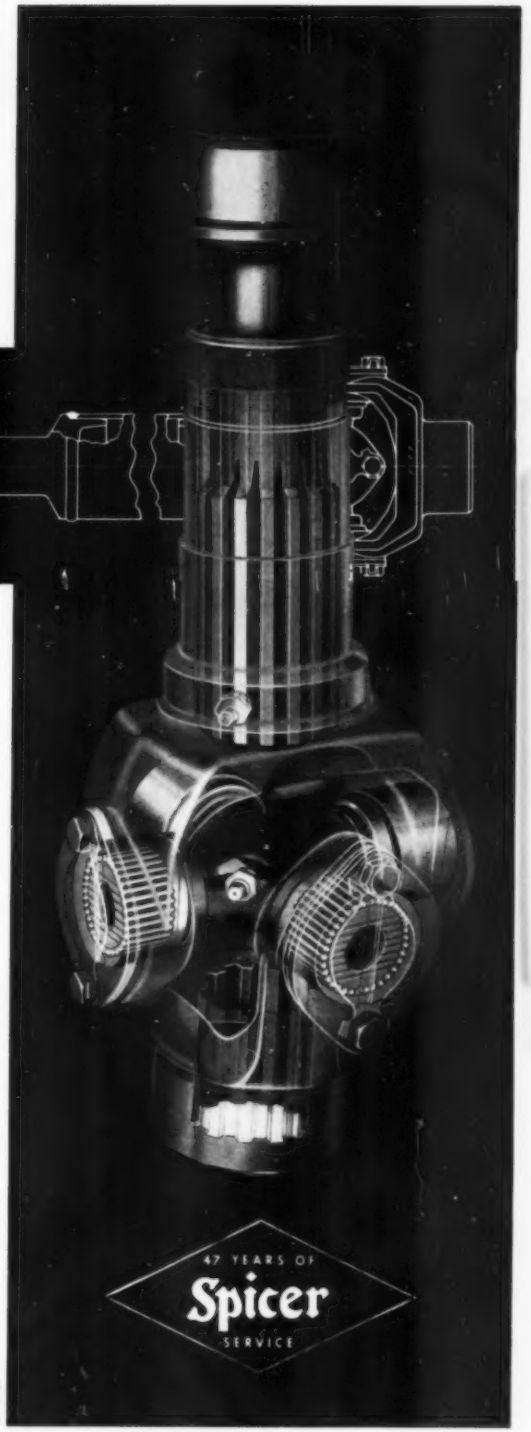
NAVY LIFTS A-BOMB

Two Navy planes are now equipped to carry the atomic bomb, and trained

LET'S TAKE AN X-RAY LOOK

at the service features in the Spicer Universal Joint





1. Sliding splines have ground finish on ALL contact surfaces, extra hardness, and iron manganese phosphate coating.
2. True bearing alignment with rigid one-piece yoke design. *Rigidity is the essence of accuracy.*
3. Precision bearings with improved surface hardness and finish.
4. Dynamically balanced to exacting limits.
5. Uniform high quality propeller shaft tubing. *Steel meets our special specifications.*
6. Wide selection of sizes and types to suit each individual application.

47 YEARS OF Spicer SERVICE

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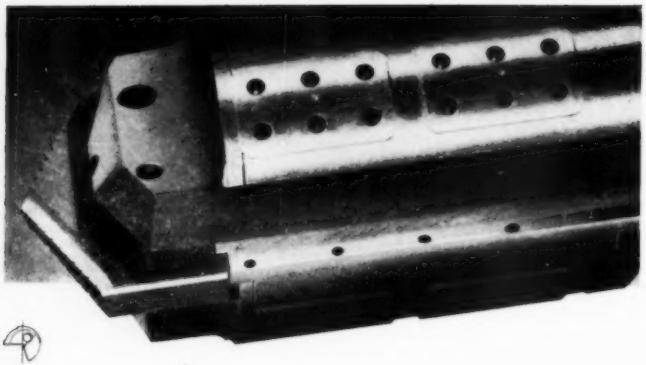
Division of Dana Corporation • **TOLEDO 1, OHIO**

TRANSMISSIONS•UNIVERSAL JOINTS•CLUTCHES•PARISH FRAMES•FORGINGS
PASSENGER CAR AXLES • STAMPINGS • SPICER "BROWN-LIPE" GEAR BOXES
TORQUE CONVERTERS • POWER TAKE-OFFS • RAILWAY GENERATOR DRIVES



DEEP HOLE TOOLING

Maybe your product calls for a ten-inch hole. That's a *large* hole. Or maybe it's just three inches, but five feet deep . . . that's both a *large* hole and a *deep* hole. Or a 3/16 hole, running the length of a rifle barrel . . . not large, but very *deep*.

Those are difficult holes to drill; from the solid that is, in one continuous operation . . . especially in today's tough and hard alloys, heat-treated before machining.

Indeed, the difficulties in what we generally call "deep hole drilling" increase three ways: with the diameter, with the depth, and with the hardness of the material.

Drilling and boring holes like these requires specialized engineering, including the selection of the right machines and equipment, and tool design backed by long experience.

This experience is not just under our hats. It's on paper, in carefully kept records, and it's in glass jars, containing our collection of chips.

We keep our eyes on those chips, because we know that every tool we design must produce chips of carefully determined size and shape, so they can be flushed out of the hole without interruption.

Ample flow of coolant must be provided through the inside and along the outside of the tool to carry off the chips, yet, the necessarily long tool body must be strong enough to prevent torsional deflection which might cause chatter.

To strike the fine balance between these various factors has been daily work at CONNER's for so long, that CONNER tool designs never fail to give calculated results, providing they're put to work as recommended.

So, if your products call for deep holes, come to us. We don't know what your problem may be, but, in most cases, we have been able to provide tools of such design that the first pieces produced passed inspection.

CONNER also offers its services:
- **as Consultants, to devise production methods**
- **as Toolmakers, to supply standard and special tools**
- **as Drillers, to do deep hole work for you.**

Conner
TOOL & CUTTER CO
C|C

Deep Holes Exclusively

1000 East McNichols Road, Detroit 3, Michigan

crews are ready to assemble and install the bombs aboard carriers. The two planes are the North American AJ-1, a combination piston-jet plane, which is the heaviest carrier-based model operated by the Navy; and the Lockheed P2V-2 Neptune, which also has been launched from and landed aboard Navy carriers.

NEW BRITISH RIFLE

Britain now has a newly designed .280-inch (7-mm.) rifle for use in the British Army. The new weapon, known as the E.M.2 self-loading rifle, is shown at the

The British .280 rifle (left) and the caliber .303 No. 4 rifle (right).

left in the accompanying photograph being demonstrated at Warminster alongside the standard No. 4, caliber .303 rifle. The new weapon holds twenty rounds of the smaller and lighter ammunition in a magazine behind the trigger mechanism. The optical sights need no mechanical adjustment for use at different ranges. The rifle is almost one pound lighter than the No. 4.

NEW DRUG FOR MALARIA

A rapid cure for malaria may be provided by a new drug, primaquine, now being tested extensively in the field. Tests already conducted indicate that primaquine may be a far more effective treatment for malaria than any other drug now in use, according to Maj. Gen. George E. Armstrong, Army Surgeon General. He emphasized, however, that further research is necessary to determine whether it will prove as effective against the strain of malaria found in Korea as it has against experimental strains.

RECONNAISSANCE CAMERA

A camera that could photograph all of Pennsylvania on a single roll of film in less than a day from 40,000 feet has been built by the Perkin-Elmer Corporation in coöperation with the Air Force. Key to the new device is a huge, 90-

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You can count on Continental

CONTINENTAL SCREW COMPANY
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Manufacturers of famous HOLTITE-Phillips and Slotted Head
Screws and Bolts and Allied Fastenings, both Special and Standard

HOLTITE *Engineered* FASTENINGS

Rockwell Report

by **W. F. ROCKWELL, JR.**
President
Rockwell Manufacturing Company

IT IS WELL ESTABLISHED that taximeters are fair to the riding public, fair to city authorities and fair to taxicab owners. The great majority of cities in this country and many foreign countries have ordinances requiring metered taxi service to eliminate the confusion, inequities, and misunderstandings that go with flat or zone rates.

Yet there are still thousands of towns without a law requiring meters. Until about two years ago, such a city was Winston-Salem, N. C. When a metering ordinance was passed, most of the cab companies installed Ohmer meters, built by our subsidiary, the Rockwell Register Corporation. Subsequently we got this letter from the Mayor of Winston-Salem:

"Now that Ohmer taximeters have been installed in our city about a year, I want to say that our city authorities have had no complaints about drivers trying to cheat passengers, etc. This shows that taximeters are much better for the riding public and for the city authorities, and from what I hear from the cab owners and drivers, both of them are well satisfied. In other words, everybody is happy over the fact that the Winston-Salem Council decided to install meters in all our cabs."

* * *

Water for Greater Los Angeles area is carried to consumers through two tremendous aqueducts, each over 300 miles long. This supply of fresh water has transformed a semi-arid section into one of the country's most favored regions. Yet, water rates compare favorably with those elsewhere. Little is wasted. Why? Because an accurate, working meter is installed on every service. Water waste is one of the most important factors in depleting vital water supplies in many regions. Universal metering has been proven to be the only permanently effective control on the waste of water.

* * *

Although we advertise that Rockwell-built Delta power tools are for wood and metal working (which they are) customers are constantly reporting successful operation on a wide variety of unrelated materials. For instance—

Electrical Installation Fabricators, Inc., Chicago, uses Delta bandsaws and lathes to cut, then turn, Bakelite.

Hoberg Paper Mills, Green Bay, Wis., cuts slabs of paper towels on Delta bandsaws.

National Scientific Products Corp., Chicago, adapted Delta drill presses to slice wafer-thin quartz crystals for communication instruments.

Boothcraft, Inc., machines Formica restaurant tops on Delta tools.

Shuron Optical Co., Inc., Geneva, N. Y., modified Delta drill presses to diamond mill lenses for optical equipment.

* * *

Rockwell plants vary in size from 10 to around 800 employees. The majority employ 250 to 500—small enough for workers and supervisors to become well acquainted, small enough for ability to be recognized, small enough for manufacturing flexibility. A headquarters staff of specialists in research, engineering, finance, taxes, patents and marketing gives each of these relatively small divisions services ordinarily available only in large companies. In these days of complicated business life we believe that this combination of localized manufacturing plus specialized management services goes a long way toward successful company operations.

One of a series of informal reports on the operations and growth of the
ROCKWELL MANUFACTURING COMPANY
PITTSBURGH 8, PA.
for its customers, suppliers, employees, stockholders and friends.

New Developments

pound prism that hangs beneath the lens and rotates in a semicircle, taking in everything from horizon to horizon in one sweeping look.

RADIAL DIESEL FOR SUBS

The newest attack submarines will be powered by a compact, radial-type diesel engine which is now ready after five years of development work. The new diesel is a 16-cylinder, 2-cycle type, mounted vertically, with four rows of cylinders branching out radially. Welded steel construction, plus other new design features, make it the lightest diesel engine in its power range. It is about half the weight of engines the Navy has been installing in its submersibles.

SUB KILLER

The U. S. Navy's newest and one of its most deadly antisubmarine weapons, is the Martin P5M-1 Marlin flying boat.

The Martin P5M-1 Marlin flying boat.

Power is furnished by two Wright turbo-compound engines, each developing 3,250 horsepower. Equipped with the latest electronic devices for the detection of submarines, the Marlin also carries the armament with which their discoveries can be destroyed.

THE F-84G THUNDERJET

The F-84G Thunderjet is the first operational jet fighter plane to roll off the production line fully equipped for mid-air refueling by tanker planes. The new plane features several new improvements over its more famous battle-tested F-84E sister model which is currently in service in Korea, Europe, England, and the U. S. It has longer range, faster climb, and provides for easier maintenance.

Single-point, in-flight refueling as featured by the "G," heralds the beginning of an era of increased flexibility and mobility for U. S. Air Force fighters. The refueling system of the F-84G is designed for use with the Boeing developed "flying-boom" method of in-flight refueling. This is the same type of system employed for mid-air refueling of bombers. A complete refueling can be accomplished within 2½ minutes with fuel passing to the fighter plane at the rate of several hundred gallons a minute.

CLASSROOM *in the clouds*

► Nearly a year of intensive air and ground training is needed to qualify an Air Force student as a navigator. To speed up the training program, the Air Force now instructs groups of 10 to 14 men simultaneously in flying classrooms equipped with Sperry instruments.

► Minimum tie-ups of valuable manpower and equipment . . . realistic training in navigating and tactical procedures . . . individual instruction of trainees are the results of the speeded up training program in the new Convair T-29 flying classrooms.

► Students have finger-tip access to Sperry equipment which helps them solve involved navigational problems – even extremely difficult ones met over unchartered polar areas.

► Sperry navigational facilities provided are the Gyropilot*, its standard accessory, Automatic Approach Control, and flight instruments for attitude and direction. Fourteen repeaters . . . one at each student station . . . are controlled by the Master Gyrosyn Compass. Thus Sperry – by providing the very latest aids to navigation – helps the U. S. Air Force develop new "men of precision."

SPERRY GYROSCOPE COMPANY
DIVISION OF THE SPERRY

*T. M. Reg. U. S. Pat. Off.

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Advanced TECHNIQUES IN STRATEGIC PRODUCTION!

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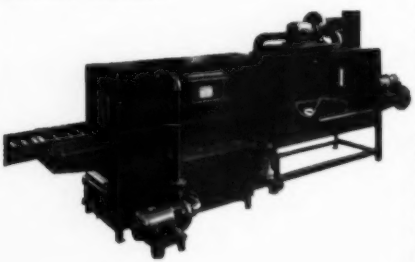
Pictured here are A-F Roller Conveyors, with especially designed skid platforms, for storage and curing of painted shell casings. Empty casings are stored in rotation order, ready for loading. Results: time saved . . handling reduced . . floor space saved . . efficiency increased!



Teamed with A-F Conveyors for fastest defense production are A-F Washing Machines. This gas-heated A-F Rotary Drum Washing Machine washes and dries instrument parts, cartridge links, clips or rifle parts. It utilizes exhaust heat for drying, and it has an automatic discharge chute. Loading hopper may be operated from either end of machine.

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Bearings in instruments and machines need no oil with a self-lubricating metal alloy on which patent 2,588,523 was awarded to Paul E. Luther, Olean, N. Y. The alloy, by weight, is about 67 per cent copper, 16 per cent lead, 11 per cent tin, 6 per cent German silver, with tiny amounts of antimony and phosphorus copper. It is put together in a flux containing borax, yellow soap, sulphur, and a fatty substance such as butter. Castings produced from this self-lubricating bronze, as it is called, are readily machinable to a fine, satin-like surface structure.

FAST PHOTO PROCESS

A new photo processing method which completely eliminates the necessity for washing films and prints has been developed by the Signal Corps Engineering Laboratories at Fort Monmouth, N. J. In practice it solves a major combat photography problem of securing adequate supplies of fresh water in battlefield areas. Use of the process, known as stabilization, permits processing time to be cut to a minimum. By eliminating the necessity for washing, plus use of specially formulated developer, stop bath, and stabilizer solutions, processing is about ten times faster for films and about twice as fast for prints.

AIR-GRAVEL CONCRETE

A lightweight concrete recently developed by R. C. Valore, Jr., and W. C. Green of the National Bureau of Standards substitutes air bubbles for sand. Suitable for the construction of monolithic walls and other elements of small structures, this "air-gravel concrete" grew out of a request from the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering for a material particularly adaptable to farm buildings. The many tiny air bubbles enclosed within the material not only replace the sand used in ordinary dense concrete, but also make the product lighter in weight.

TWO NEW COMPASSES

Two new types of compasses designed to assist ground forces in reconnaissance and navigation and for aiding forward observers in directing fire control have been delivered to American forces in Korea. Developed by the Army Engineer Research and Development Laboratories at Fort Belvoir, Va., the new wrist-type compass and the lensatic compass are light, accurate, sensitive, and rugged enough to withstand the most severe conditions of combat for a long period. They are resistant to water, weather, shock, mildew, and fungi, and have been drop-tested for air and airborne operations.

U. S. M. C. photo

Navy Corsair chars Communist position in Korea with Napalm (jellied gasoline) bomb in answer to Marine infantry's call for tactical air support.

Fuze parts for Napalm bombs like the one here shown blasting enemy forces in Korea must function with absolute dependability. Fuze parts to meet such exact standards are die cast by Precision, along with hundreds of other items vital to the nation's defense effort. Whatever *your* defense production problem, Precision will solve it with a precisely accurate, lighter, stronger, low-cost die casting . . . a *Precision* die casting.

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IRON POWDER—For shell rotating bands; for parts for guns, tanks, airplanes, jeeps, trucks, missiles and other military items; for electronic cores and magnets used in radio, radar, sonar and other communication and detection equipment; and for a wide variety of additional applications essential to National Welfare and Defense.

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FROM THE RECORD

FOR BALANCED FORCES

We cannot effectively maintain our defensive frontiers in Europe and in Asia without troops and ships and planes located in strategic positions for the support of our allies.

Air attack alone will not stop the advance of the Russian Army against Western Europe. In Korea there has been no appreciable enemy opposition to our use of the air, and though we have had a zone of approximately 150 miles over which our air effort was free to operate, there still has been no effective retardation of the enemy advance by means of air alone, including naval aviation.

Russia's Objective

If Russia is successful in establishing herself across Europe to the Atlantic seaboard her objective will have been attained and the burden of meeting her next advance will fall upon our children.

In all sincerity and with great emphasis, I suggest that the next war, if it comes, will be fought by persons who will be, and will remain, at or near the scene of action and that the conventional type of warfare with which we are all familiar has not become obsolete.

I do not mean to leave the impression that I am not fully conscious of the value of the airplane as a weapon. It is of great importance. We must have strength in the air. The plans which we are now pursuing are not negligent of the air. They envision its use in many rôles—strategic bombing of the enemy's hinterland, close tactical support of troops, interdiction of supply routes, and anti-submarine warfare.

Naval Aviation

In fact one of the reasons I so earnestly support the principle of service balance is that a system of priorities in the provision of armaments could result in a curtailment of naval aviation, just as it could curtail electronic equipment for airplane and submarine detection or steel for tanks. Strength in the air being of the importance claimed for it, I see no reason for reduction of the power of naval aviation. Remember always that naval aviation is an important part of the air power of the United States.

A navy, mobile and ready, is an instrument particularly well adapted to the maintenance of force on defensive frontiers far from home.

In World War I, the spearhead of the Navy's striking power lay in the big guns

NEW KINDS OF BRAKES GET TOUGH TESTS

How Chrysler Corporation engineered and built better brakes for the new cars and military vehicles

SEAGOING SEDANS. Arkansas "mud test" of Chrysler-designed brake seals, best ever made to help keep out mud and grit. They protect famous Safe-Guard Hydraulic Brakes. These brakes have two extra cylinders, for smooth, controlled stops. They're on Plymouth, Dodge, De Soto cars, and all Chryslers except Crown Imperials, which have disc brakes.

The picture story on this page was made by photographer Jerry Cooke, famous for "picture reporting" in leading magazines. He traveled 7000 miles to get a story on the development and testing of the latest thing in brakes for Plymouth, Dodge, De Soto and Chrysler cars, and the newest military vehicles built by Dodge Truck.

Cooke shows you how safety is built into cars which play such an important part in the lives of Americans . . . and gives a glimpse of the way a big automobile company handles defense assignments.

STOPPING ON 60 PER CENT GRADE. Dodge-built Army cargo truck demonstrating braking power at U. S. Army Ordnance Proving Grounds, Aberdeen, Md. Special new Chrysler-engineered brakes take hold easily . . . last six times as long as brakes used on similar vehicles in World War II.

NEW DISC BRAKES. W. R. Rodger, brake development engineer, shows parts of Chrysler's new disc brakes. They operate with light pedal pressure, *never* need adjustment, stay effective even with many repeated stops. *At right* is cutaway of unique forced-air cooling system that makes new brakes last longer. Fins create cooling air current. "Cool" brakes mean safer driving.

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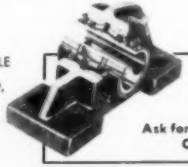

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of battleships. World War II saw the transition to the airplanes of carriers. We had 110 carriers in World War II, large and small, fast and relatively slow. They spent a combined total of 940 months—over 78 years—in combat areas. They operated by night and by day in all kinds of weather. They were exposed to every variety of attack in restricted European waters as well as in the Pacific. Of these 110 carriers, only 11 were lost—an average loss of one carrier to every 85 months of combat operation.

Can Fight Again

I give you these statistics on carriers because they are often spoken of as being a particularly vulnerable type of ship and because the carrier is the core of the Navy's offensive strength. The ship with its arms may be moved readily to new locations as need arises. But, most important of all, when it has done its work it may be brought home and preserved to fight another day.

The protection afforded by the Navy today is costing less because the ships which fought World War II are still in being—need only be brought from "mothballs" and placed in service. . . .

I do not mean to suggest that the Navy alone can accomplish the whole business of manning a defensive frontier abroad. Troops are needed which must come from the Army. The power of the Air Force will be required at the scene of prospective action. The range of the Navy's guns and planes is limited. But the Navy is peculiarly well adapted for a large share of the work. All services have gained invaluable experience in Korea and are better for the knowledge gained in that unfortunate land.

Naval forces in strength must be maintained in the Mediterranean, in the Eastern Atlantic, and in the Western Pacific. They are required at the focus of infection of Communism, and they can be deployed quickly as that focus shifts. . . .

An Adequate Defense

The problem of our country is to bring about an adequate level of defense for ourselves and our allies quickly and without wrecking our own economic structure. This is a difficult task. It has been my purpose to emphasize a few of the fundamentals which I regard as important in performing that task. The frontiers must be located at a distance from our shores.

Fortunately, such frontiers exist. Let us exploit them to the maximum. Let us build our strength toward the enemy's weakness so that he will not be free to choose his place and weapons.—ADM. WILLIAM M. FECHTELER, *Chief of Operations, United States Navy, before the Women's Press Club, Washington, D. C.*

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LIEUT. COL. JOHN J. DRISCOLL, *author, air armament engineer, air combat officer, Headquarters, United States Air Force, Washington, D. C.*

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200 Miles Up. By J. Gordon Vaeth. New York: The Ronald Press Company. 207 pp. $4.50.

FOR the greater portion of man's long sojourn on earth he has had, perforce, to be content to dwell on the bottom of that shoreless ocean of air which envelops his domain. Daedalus-like he might dream of excursions into the blue of the firmament, or wish he might take flight to see "what makes the stars to shine." But never in his most vivid imaginings did he guess more than a portion of the truth revealed by modern investigation.

"The atmosphere," writes the author, "is Nature's scientific proving ground . . . containing within its seemingly limitless area the answer to many of those riddles of physics and chemistry which man has long attempted to solve by earthbound investigation.

Secrets of the atom, the sun, and of the earth itself can be found and explained in the upper atmosphere—the area of fundamental scientific discoveries!"

This work is not for the casual reader nor for a mind untrained in the elements of physics. But the author has done a capable job of interpreting such topics as temperatures of 17,000 degrees Fahrenheit at elevations of 200 miles in terms of the kinetic theory of heat, the probable causes of the aurora polaris, and the nature of cosmic radiation.

The chapter on upper air research instruments will be of less interest to the nonspecialized reader, but the explanation of the principles of rocket flight and the descriptions of the development and operation of the "big three" high-altitude sounding rockets should command his close attention. These are the V-2 of the Germans in the last war, the Aërobee of Johns Hopkins University, and the Viking of the Rocket Sonde Branch of the Naval Research Laboratory. Those with a touch of Jules Verne romanticism will be happy to learn that a one-way ticket to the moon may now be purchased for several hundred million dollars, with no very secure guarantee of completing the journey.

Chapter V on "Project Skyhook" will doubtless be voted the most intriguing of the book. The Skyhook is a very special sort of balloon capable of carrying a pay load of 300 pounds to a height of 100,000 feet, or about 19 miles. It has a polyethylene (plastic) skin resembling cellophane and when inflated has a

AMERICAN ORDNANCE ASSOCIATION
Book of the Month for NOVEMBER

CLOSING THE RING

BY WINSTON S. CHURCHILL

This, the fifth volume of Churchill's monumental history of World War II, covers the months between Tunisia and D-Day. It is Churchill's personal top-level story of the decisions that ultimately led to the closing of the war: the Quebec decision on the atomic bomb, the conference at Teheran, the relations with General de Gaulle, the fall of Mussolini, the grisly record of Anzio and Cassino, and the building of the tremendous army to cross the Channel.

Winston Churchill remains unchallenged as the greatest statesman-historian of our age. "Closing the Ring," more personal than the earlier books, is concerned with a year that may emerge in the final reckoning as the most important, politically, of all the years of World War II.

Special Prepublication Offer
if ordered before November 22nd: Retail, $5.00; to members, $4.50.
—after November 22nd: Retail, $6.00; to members, $5.40.

CIVIL DEFENSE IN MODERN WAR

By Brig. Gen. A. M. Prentiss, Jr.

This highly instructive manual discusses modern warfare with regard to air attack on civilian populations and sets up a detailed plan for a general civil-defense organization. Fully illustrated, it is a guidebook on the protection of civilians against atomic, bacterial, and chemical warfare.

Retail, $5.00. To members, $4.50.

THE MACARTHUR I KNOW

By Gen. George C. Kenney

General Kenney gets through the myth to the man. The military strategist, the militant statesman, the commander, the comrade-in-arms on the battlefield or relaxing with friends—all the MacArthurs are here in this warm yet penetrating study.

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MELVILLE GOODWIN, USA

By John P. Marquand

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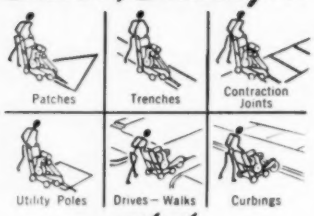

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Book Reviews

pear shape 72 feet in diameter and 102 feet high. Helium bears it aloft and, once airborne, it will float for hours until leakage and diffusion bring it back to earth.

Meantime it may have caused no little alarm as, for example, when it paused on one occasion high above a large city as the sun set and darkness spread upon the face of the earth, while the balloon itself remained brightly illuminated by the sinking sun.

But not all "flying saucer" reports can be attributed to the Skyhook. Read what the author has to report on a whitish elliptical object observed by a tracking theodolite from the White Sands Proving Ground in New Mexico on April 24, 1949, and reach your own conclusions.—ARTHUR F. MACCONOCHIE, *head of the Department of Mechanical Engineering, University of Virginia, Charlottesville, Va.*

Modern Ordnance Production. Compiled by the editors of *Steel*. Cleveland: Penton Publishing Company. 186 pp. $2.50.

IN this highly illustrated paperbound book the editors of *Steel* have assembled all the material published during World War II and subsequently in a representative review of ordnance production methods. Few technical magazines equaled the broad coverage of *Steel* during the last emergency in a comprehensive analysis of ordnance technical problems.

The availability of many of these texts in so complete and attractive a volume should be a boon to many producers who are face to face with ordnance production under the current rearmament program.

Many of the articles covering the whole category of ordnance are by well-known authorities. We call particular attention to the fact that in its compilation a vast portion of the data is from the pen of Prof. Arthur F. MacConochie, head of the Department of Mechanical Engineering at the University of Virginia and a widely known member of the Ordnance fraternity.

Professor MacConochie has the facility of presenting otherwise complex production techniques with crystal clarity. His long years as a teacher at the university are evidenced by his ability to portray principles and details with conciseness.

The scope of the articles covered includes heat-treatment process, principles of cold extrusion, cartridge-case manufacture, guns, high-explosive shells, fuzes, and combat vehicles. There is also a section of miscellaneous production and inspection techniques.

All told, this volume of 186 pages should be of considerable service to technicians who are struggling to increase ordnance production.—LEO A. CODD.

The Serviceman and the Law—Sixth Edition. By Col. Morris O. Edwards and Charles L. Decker. Harrisburg: The Military Service Publishing Company. 401 pp. $3.50.

YEARS ago this reviewer was suddenly assigned many duties pertaining to trials by court-martial. He would have saved many an hour of reading and would have made many less mistakes if he had been fortunate enough to have had available a copy of a book similar to this one. The occasion for the publication of this sixth edition is the enactment by Congress in May 1950 of the Uniform Code of Military Justice for all three services, Army, Navy, and Air Force. This book is a supplement to the Manual for Courts-Martial, United States, 1951, but it has no official status.

This book will be of special value to enlisted men who may be assigned as members of courts-martial, as well as to officers who are assigned to duty as members of courts-martial and especially to those who may be eligible to be the president of a court. It will also be helpful to organization commanders who are required periodically to explain certain articles of the Code to members of their organization.

The book explains some of the new features of courts-martial such as the right to have enlisted men as members of courts and the new and enlarged functions of law members. It also goes into the new legal training qualifications for trial and defense counsels.

It is not difficult to read. It should be of value in any officer's professional library. One of the impressions left with the reader the first time he looks over the book is the possibility that under the new code, with more trained lawyers available for participation in courts-martial, there may be more law in the future and perhaps less justice.—PHILIP SCHWARTZ.

American Campaigns. Volume I. By Matthew Forney Steele. Washington: Combat Forces Press. 338 pp. $6.

FIRST published by the War Department in 1909, each of the twenty-seven chapters of Volume I of "American Campaigns" represents a lecture on military history delivered by Colonel Steele during 1906-1909 at the Army Service Schools. More than two-thirds of the text is devoted to the Civil War, while 115 pages cover the Colonial operations, the Revolution, the War of 1812, the Mexican War, and the Spanish-American conflict. Volume II of this work will consist of the maps pertinent to the text which comprises Volume I.

"American Campaigns" was virtually the only collection of historical studies adapted to military teaching in 1909. Since then, it has been superseded by

So now you must make something different, eh!

As a subcontractor you have been asked to furnish a product for the emergency. Fine. You have all the facilities to produce it, with one exception—the manufacture of one component—a tubular part—which is "a little out of your line."

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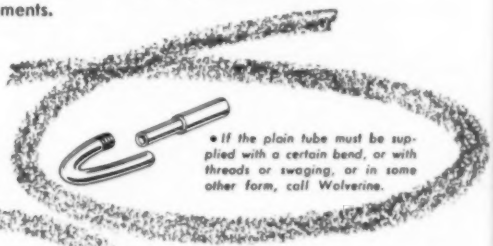
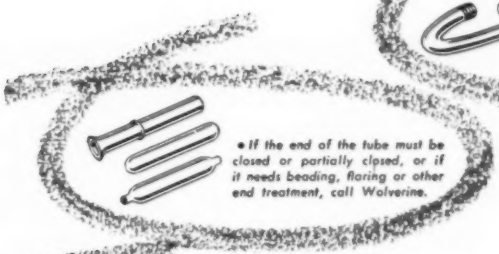


• If the plain tube must be supplied with a certain bend, or with threads or swaging, or in some other form, call Wolverine.



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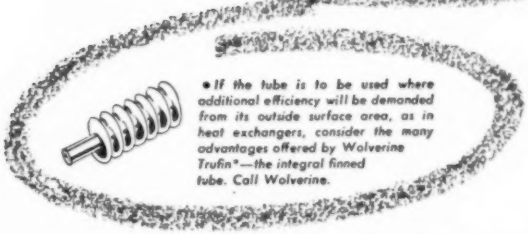

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Book Reviews

many newer works. Not only have the forty-two intervening years been crowded with campaigns of tremendous import, and the science of war revised to accommodate the great military technological developments of the period, but many new sources shed additional light on the old campaigns.

Then, too, the writing and, to an extent, the teaching methods have been largely changed. The lectures which are gathered between the covers of this volume were designed as a "cramming" course of rapid evaluation. They lack both the narrative effect and the critical study afforded by some of the military histories of today. Nevertheless, the book does furnish a valuable compendium of the Nation's campaigns to the close of the nineteenth century.

Perhaps the strangest feature of the work, and certainly the saddest commentary on the manner in which military history was taught to our older officers, is its complete lack of attention to the weapons which, presumably, were employed by the land and sea forces of both sides. The book's index simply contains no entry under "arms," "guns," "munitions," "weapons," or the like. Nor does a perusal of the text yield more than a very occasional mention of the same.

The War of the Revolution might have witnessed the general use of magazine weapons or the Spanish War been the last of the smoothbore conflicts for all the information we are furnished. True, we of the Ordnance fraternity are accustomed to a great deal of neglect of the "tools of war" throughout very nearly all military history, but this one achieves an almost perfect blank!—F. W. FOSTER GLEASON.

Kill or Get Killed. Second Edition. By Lieut. Col. Rex Applegate. Harrisburg: The Military Service Publishing Company. 316 pp. $3.75.

COLONEL APPLEGATE is unquestionably a leading authority on hand-to-hand and close combat. His background and experience are unusual. An expert instructor whose services were of great value during World War II, he is also a fluent and interesting writer.

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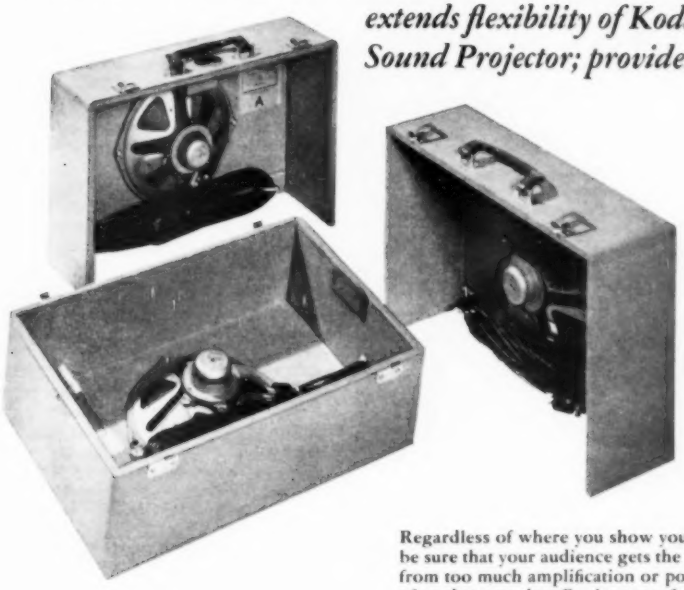

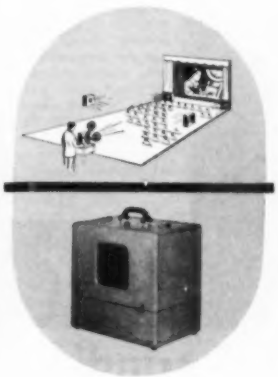

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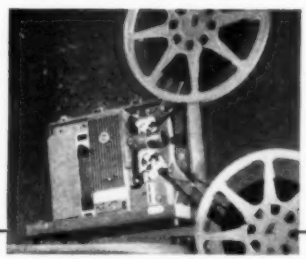

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Book Reviews

simple methods in close combat. He debunks "judo" and "jujitsu." The user is often helpless to perform according to these oversold techniques unless the opponent "performs in the specified manner taught in the course."

"No text," writes the author, "no matter how well illustrated or clearly explained can, alone, teach a man to fight. It can only serve as an instructional guide." He urges closely supervised intensive practice.

The author describes a variety of clever and simple methods which can overcome an unarmed or armed opponent. He devotes some attention to the knife and debunks a number of picturesque impractical holds. He does not advocate throwing a knife because of the control-of-spin and distance problems. Also, one throw and you are wholly disarmed. Against an adversary graduated from the Colonel's school, this reviewer would suggest one determined half-turn, blade-held, overhand knife throw at twenty-five feet—and then run like hell!

The author shows various methods for disarming, and describes means for handling prisoners. Brief attention is given to room raids, and more would have been welcome as to elementary fielderaft. Bayonet fighting is omitted in this book, possibly because so very little actual bayonet fighting takes place today.—MELVIN M. JOHNSON, JR.

Technique for Adjutants. By Maj. Arthur M. Chester. Washington: Combat Forces Press. 98 pp. $1, paper; $2.50, cloth.

A BRIEF handbook which furnishes workable hints and procedures for setting up and operating an adjutant's office at any staff level. The official publications on this subject are cold, formal, scattered, and of little help to the adjutant who is confronted with immediate organizational and procedural problems. This handbook covers the practical points of office layout, subordinate training, order writing, filing systems, courier service, and calling protocol, to name a few. It devotes a large section to inspection check lists, with emphasis on morning report checks.—THOMAS K. VINCENT.

The United States and France. By Donald C. McKay. Cambridge: Harvard University Press. 334 pp. $4.

THIS is the ninth and latest volume forming the "American Foreign Policy Library." There may be some who will be relieved to know that, though we have no recognizable foreign policy, we do have a "library."

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Book Reviews

said library. Sumner Welles, who wrote the introduction, is editor of both library and book. Together with its emanation from Harvard Yard, these facts add up as simply and as inevitably as a proposition of Euclid: it is a Global Work, though America is along for the ride (and to pay the bills!).

In the introduction, Mr. Welles tells us "France has long been and is today more than ever before the keystone in the arch of Western European security." Readers can decide for themselves whether they wish to stand under that arch—or stand from under. Again: "We Americans seem all too prone to forget the tragedies that France has suffered since 1914." Not so, Mr. Welles: rather are we all too prone to forget the appalling degeneracy that sired those tragedies!

The book is well written and Mr. McKay knows France and French history. He writes objectively as to the facts themselves, but it is in the selection of some facts, the soft-pedaling of others, and the general slant of the thesis that objectivity suffers. The emasculation of Austria after the First World War (direct reversal on Napoleon's last testament) is unnoted, and the enormities of Leon Blum's Popular Front are quite hushed. It is all, of course, a matter of fundamental choice. Those who applaud the "bottomless pit" of Korea may well enjoy a volume which offers a prospect of more and bigger such adventures!—F. W. FOSTER GLEASON.

Chemical Spectroscopy. By Wallace R. Brode. Philadelphia: American Society for Testing Materials (Edgar Marburg Lecture). 52 pp. $1.35.

A PENETRATING insight into the philosophy and techniques of chemical spectroscopy is afforded by this monograph. The author, W. R. Brode, has long been a leader in this field and is now Associate Director of the National Bureau of Standards.

During the past twenty years spectroscopy has developed into a tool of great power and versatility in the control of manufacturing processes such as those in the metals and petroleum industries. Dr. Brode's discussion of emission and absorption spectroscopy in the ultraviolet and infrared as well as the visible spectrum provides the background for understanding the present remarkably widespread applications.

Another interesting point is the reciprocal stimulation observed historically between the development of the two related fields of practical spectroscopic chemical analysis and the physical theory of the nature of the atom.—DR. ALFRED WEISSLER, *Army Ordnance Research and Development Division.*

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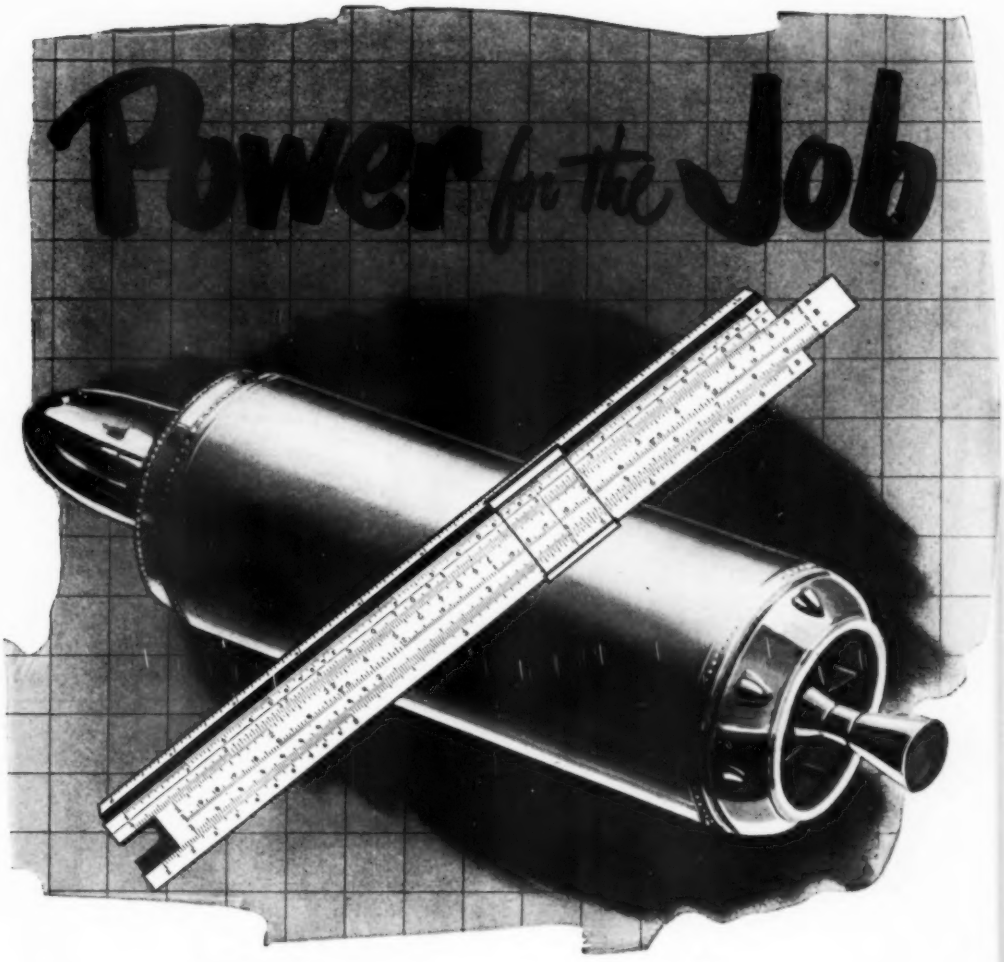

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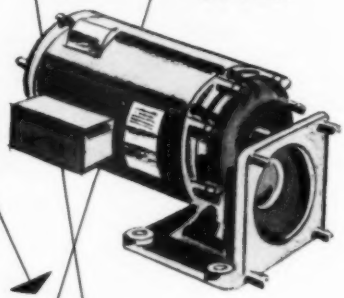

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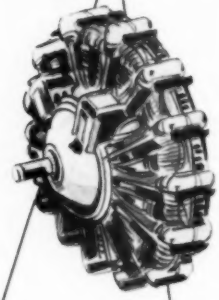

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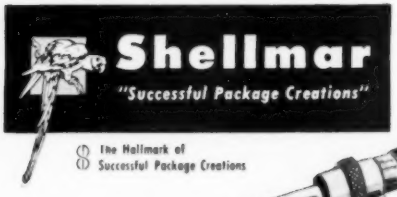

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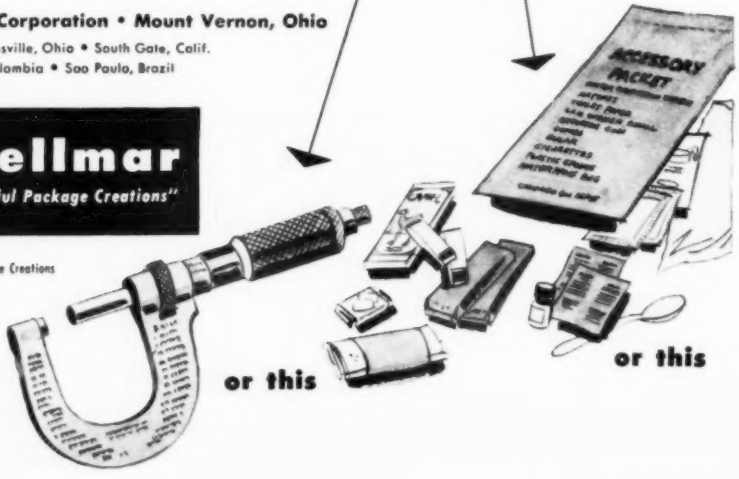

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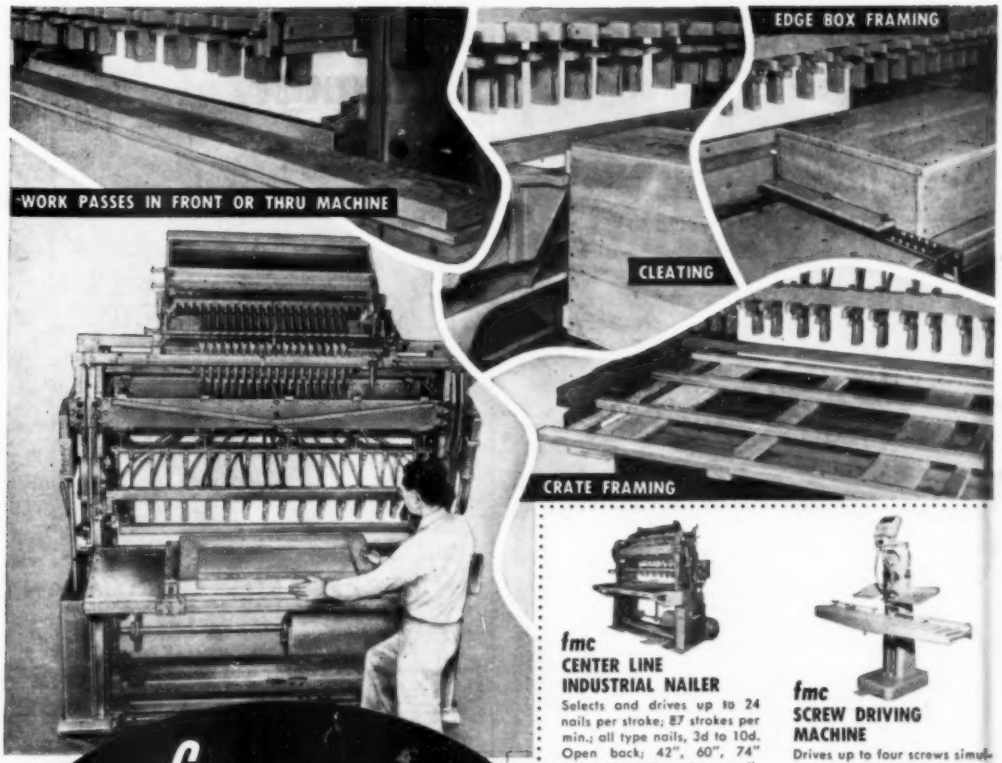

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SOLVES *your* NAILING PUZZLE!

By mounting nail chucks in *front* of the frame, fmc engineers have produced the most versatile nailing machine on the market today. The design permits work being nailed to be passed in front of the machine as well as through it . . . *regardless of length* in either nailing operation. Nailing tables, jigs, cleating attachments and any special equipment needed are specifically engineered to job requirements. Fill out coupon at the right for complete, fully illustrated details.

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Selects and drives up to 24 nails per stroke; 87 strokes per min.; all type nails, 3d to 10d. Open back; 42", 60", 74" standard widths; others available. Designed for large scale industrial nailing.

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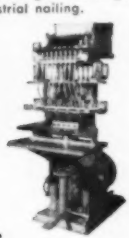

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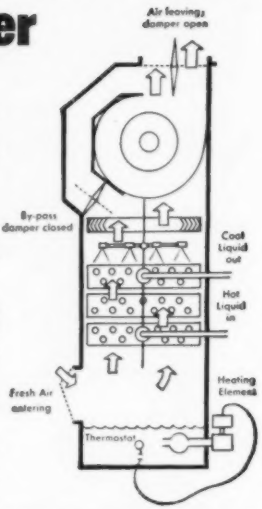

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SELF-PROPELLED artillery. New M 41 Motor Carriage with 155 mm. Howitzer. Equipped with two South Wind "978's" for personnel heating, and for heating gun components.

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Armor Welding Electrodes . . . and all Standard Types

AC or DC . . . the BEST . . . for any weld

. . . on all types of stainless steel

STAINLESS STEEL has great strength . . . but its strength is limited by the quality of welds which seal the joints. In all kinds of manufacturing —military work in particular—stainless is being used more widely. If you weld stainless, you must choose electrodes with care.

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Saves Time by Eliminating Back-Tracking

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and the Parker Products which meet them

SPECIFICATION	PARKER PRODUCTS
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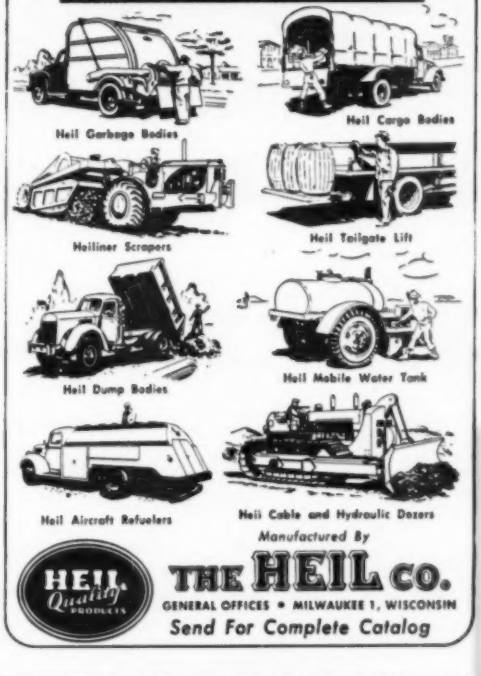
JAN-C-490, Grade I	Bonderite 100, 125, 140, 160, 170, 180
JAN-C-490, Grade II	
Type 2	Parco Cleaners 341, 350, 371
Type 4	Parco Cleaners 250, 260
Type 5	Parco Cleaners 210, 220
Type 6	Parco Cleaners 100, 101, 110
JAN-F-495	Bonderite 32, 34, 100, 125, 140, 160, 180
JAN-L-548	Parco Compound, Parco Powder
MIL-10578 (Formerly U. S. A. 3-213)	
Type I	Parco Cleaner 250
Type II	Parco Cleaner 260
MIL-C-5541	Bonderite 700
MIL-C-16232 (BuOrd)	
Type I	Parco Lubrite 1, 2, 3
Type II	Parco Compound
Naval Aeronautical M-364	Parco Compound—Parco Powder
QQ-P-416 Type III	Bonderite 32, 34
U. S. A. 57-O-2	
Type II, Class A & A1	Parco Lubrite 1, 2, 3
Type II, Class B	Parco Compound—Parco Powder
Type II, Class C	Bonderite 100, 125, 140, 160, 170, 180
U. S. A. 72-53	Bonderite 32, 34, 100, 125, 140, 160, 170, 180

For information regarding these or other specifications write:

PARKER RUST PROOF CO. 2165 E. Milwaukee Detroit 11, Michigan

Heil Service Veterans



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Here is what was accomplished just by the installation of Handy Governors on the vehicles of 180 truck fleets. The saving on tires was found to be 22.6%, on engine repairs 32%, on fuel 13.5%, on lubricants 26%, on brake maintenance 29.2% and general maintenance 26%. Furthermore it reduced insurance 16% and cut the cost of accidents 37%.

In the face of war shortages, which will certainly get progressively worse, is there any better way to conserve equipment and at the same time make substantial dollar savings? This kind of hoarding is not only legal but it pays good dividends.

Write for quotation on equipping the vehicles of your fleet with Handy Governors.

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have proven performance.

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SPARE PARTS PACKAGING for protection in handling and in transit.

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Plugs and Sleeves to protect threads.

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Special CENTRIFUGAL BLOWERS
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Designed at low cost to meet your specifications.
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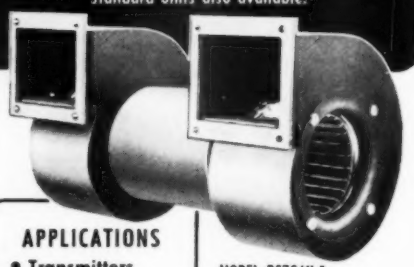

APPLICATIONS

- Transmitters
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- High Ambient Temperatures
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MODEL B57G6K-1

SPECIFICATIONS

MODEL B57G6K-1: 115 volt AC • 60 cycle • single phase • 4 mfd. • 120 CFM at 0.5" SP—220 CFM at 0" SP • Silicon impregnated windings • Fungus proof.

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Made of water-repellent asphalt composition board, Fabco Packing List Protectors are quickly applied with nails or staples. Packing lists are kept legible, easy to find and ready for immediate identification.

FABCO Packing List Protectors are approved and used by Army Quartermasters, various Navy Departments, by Signal, Marine and Medical Corps and by prime and subcontractors operating under the Armed Services. They are listed in Navy Catalogue under Stock #53-P-38250-230. The material complies with Specification MIL-B-3106 and tentative Ordnance Specification AXS-1623. Slotted separators and solid filler pads can be supplied of the same material.

Write for descriptive Bulletin 511

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To meet MILITARY SPECIFICATIONS

for Cleaning • Rust-Removing • Etching Phosphatizing and General Metal Conditioning of all kinds of Metal Surfaces

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SPECIFICATION NUMBER	CONFORMING MATERIAL
MIL-C-5541 (see also QPL-5541-1)	Lylanite
MIL-S-5002	Lylanite
MIL-C-10578	
Type 1	Metalprep Nos. 77, 102—Alumiprep No. 1
Type 2	Metalprep Nos. 10, 15—Alumiprep No. 20
JAN-C-490—Grade II	
Type 2	Emulsoprep
Type 4	Metalprep, Prep-Pik-L, Alumiprep, Prep-Rite
Type 5	Metalprep, Alumiprep, Prep-Pik-L, Prepwash
Type 6	Emulsoprep No. 710-E.C.
U.S.A. 3-213	(See MIL-C-10578)
U.S.A. 3-192	Metalprep Nos. 28, 10, 15 Alumiprep No. 20
U.S.A. 98-20007	Metalprep Nos. 10, 15 Alumiprep No. 20 Prep Rite No. 16
U.S.A. 72-53	(See AN-F-20)
AN-F-20	Lylanite
	Metalprep Nos. 10, 15, 77, 102 | See MIL-C-10578 Alumiprep Nos. 1 and 20
AN-E-19	Lylanite
AN-C-170	(See MIL-C-5541)
TAC-ES-431	(See MIL-C-10578)
AXS-1245	(See JAN-C-490, Grade II)
Engineering Corps—T-1184	Metalprep No. 78
U.S.N.—Appendix 6 51-C	Metalprep

Send for Data Sheet • Advise Govt. Spec. Number

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Stripped, seized, corroded and worn threads on tanks, motors, automotive and other ordnance equipment can be easily and quickly repaired with Heli-Coil Screw Thread Inserts of stainless steel wire.

New simple Heli-Coil kits for such repairs have Ordnance approval. Similar kits can be provided for #6 to 1½" size in National Coarse & Fine threads, automotive and aviation spark plugs, and pipe thread sizes.

Heli-Coil Inserts fit in Heli-Coil-tapped holes replacing the damaged threads with new threads taking original size bolt, stud or cap-screw . . . distribute all stress through full length of thread . . . permit unlimited assembly and disassembly without thread wear.

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Heli-Coil Inserts eliminate all thread troubles in original equipment.

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DANBURY, CONNECTICUT

Please send me ☐ Data on Thread Repair Service Kit
☐ Bulletin 650 on Design Data
☐ Bulletin 349 on Salvage and Service

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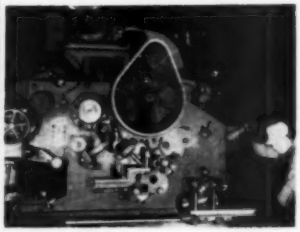
HOW THIS MULTI-PURPOSE "Buffalo" MACHINE GETS FABRICATION JOBS DONE FASTER

IN D. T. & I. Railroad Shops



• SHEARING

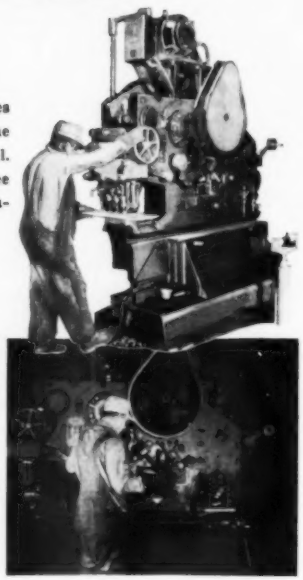
left, the "Buffalo" Armor plate Punch, Shear and Bar Cutter shears ⅜" metal in D. T. & I. Railroad Shops, Jackson, Ohio.

• PUNCHING

same machine punches 13/16" holes for engine tank on ⅜" tank steel. Punch head has three selective punch diameters.

• CUTTING

here a 3 x 3 x ¼" angle is cut square. Machine can cut and punch simultaneously. WRITE FOR BULLETIN 360-D for all sizes and models available.



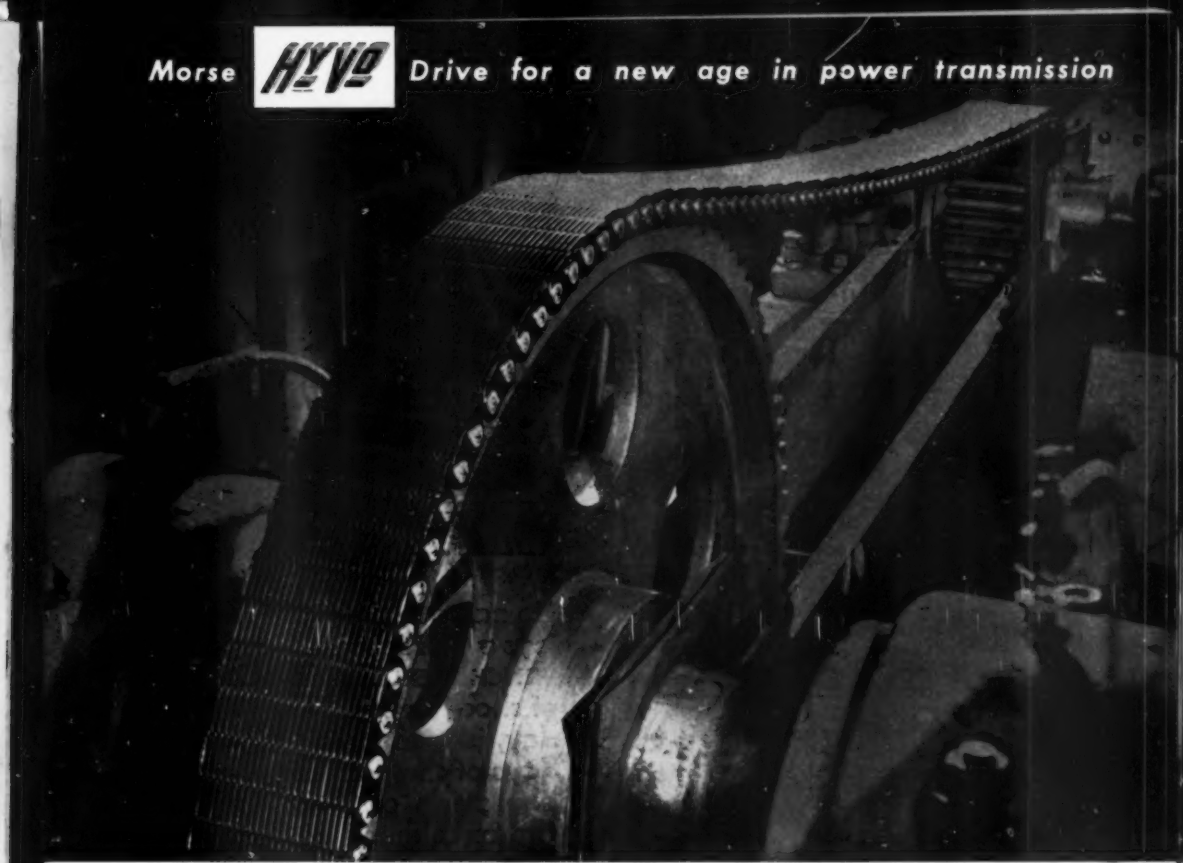
SHEAR BILLETS FAST!

"Buffalo" Billet Shears are built in 11 sizes to cut up to 10" round forging stock at 6 strokes a minute. These machines also handle squares and flat bars. WRITE FOR BULLETIN 3295-A to aid your selection of a shear for your application.

"Buffalo" MACHINE TOOLS
BUFFALO FORGE COMPANY
534 BROADWAY BUFFALO, NEW YORK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

BENDING CUTTING
SHEARING DRILLING PUNCHING

Morse **HY-VO** Drive for a new age in power transmission



Morse Hy-Vo does 50% more work with 50% less chain

on 300-kilowatt generator

A *200-kilowatt* generator on the Standard Dredging Company dredge boat "Diesel" requires a 12"-wide silent chain drive.

When an additional generator was needed, the boat owners turned to Morse Hy-Vo (above). Result? The new *300-kilowatt* generator is driven by a 6"-wide Hy-Vo Drive. That's 50% more work with 50% less chain—and another application that Hy-Vo takes right in stride.

The Morse Hy-Vo Drive gives up to one-third longer service life, cuts operating costs per hour up to 50%. Morse Hy-Vo transmits more horsepower at greater speed (up to 5000 HP at 1200 RPM) and lower cost than any other standard drive.

New age in power transmission

Hy-Vo permits the transmission of vastly increased horsepower from smaller, less expensive, high-speed engines and motors—without costly accessories. Hy-Vo is the latest addition to a complete line of products that has made the name Morse a byword for the best in power transmission equipment and engineering.

Write today for Hy-Vo Catalog C 72-51—or for information on Morse Silent Chain or Roller Chain Drives, Morse Flexible Couplings, Morse Drive Shafts, or Morse Clutches. (Hy-Vo orders must carry priority rating at present time.)

More than ever, M=PT—Morse means Power Transmission.

MORSE
MECHANICAL
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PRODUCTS OF BW

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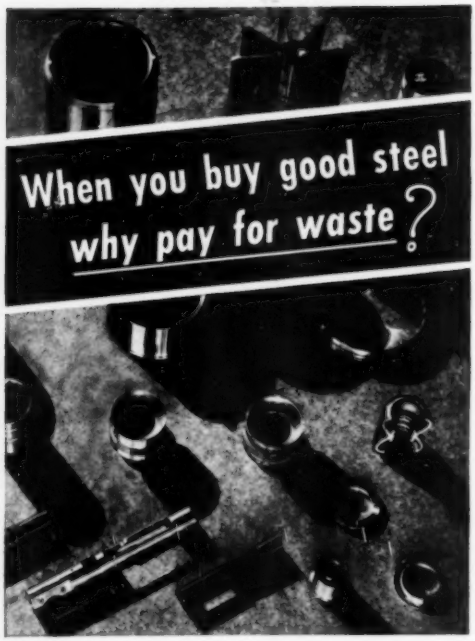

TIGHTENING the belt on production costs? Then be sure that you don't have too much of your good steel stock lying on the floor as scrap. It's wasteful, expensive and usually unnecessary.

You can save money, time and steel when you use Shelby Seamless Steel Tubing for hollow cylindrical parts. With tubing, less cutting or boring is required than with solid bars . . . tools last longer. And, since *the basic shape is already made*, fewer operations are required. Rejects go down. Time is saved.

For some good examples of how other parts manufacturers have simplified their production-cost problems, take a careful look at the products on this page. Despite the complexity of some, each of them was made from Shelby Seamless Steel Tubing. In some cases, manufacturing costs are 50% less than identical products machined from solid bar stock.

Our service engineers will be glad to help you utilize the many advantages of seamless steel tubing for *your* product. Draw upon the priceless experience of National Tube Company—world's largest manufacturer of tubular steel products.

FREE BOOKLET

Tells how to cut production time, production costs, and make better parts in the bargain. Write to National Tube Company, Frick Building, Pittsburgh 19, Pennsylvania.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
(TUBING SPECIALTIES DIVISION)
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Shelby
Seamless Steel Tubing

UNITED STATES STEEL

THEN...*and*...NOW

No name in the world enjoys a finer reputation than WINCHESTER . . . the symbol of shooting supremacy today, just as it was in the days of the pioneer West. The pride of perfection, the excellence of craftsmanship and materials that distinguish products of the WINCHESTER division of OLIN INDUSTRIES are the same marks of quality America recognizes in all of OLIN'S many products.

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Products of Divisions, Subsidiaries, Affiliates:

WINCHESTER: Firearms, Ammunition, Flashlights, Dry Cell Batteries, Roller Skates. WESTERN: Ammunition, Traps and Targets, Blasting Caps, Brass, Bronze, Phosphor Bronze, Nickel Silver, Copper. BOND: Flashlights, Dry Cell Batteries. EQUITABLE, COLUMBIA, LIBERTY, EGYPTIAN, TEXAS, WESTERN: Railway Fusees and Torpedoes, Black Powder, Dynamite, Blasting Caps.

PRODUCING BOTH INDUSTRIAL AND DEFENSE ESSENTIALS . . .

Taking this trip together

They go arm in arm today—the businessman and the man in uniform. Both have a hand in shaping our future.

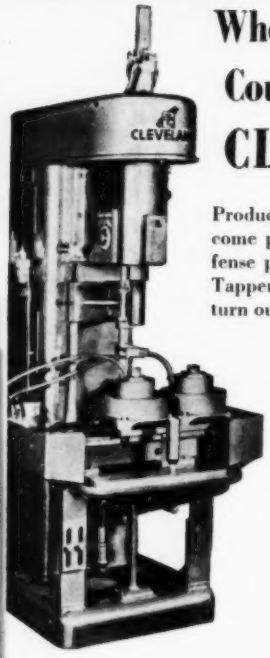
To make that future secure, there must be greater production of industrial goods to keep our growing economy sound—and greater output of military weapons to protect our freedom. American Locomotive is proud to share this challenge.

At one Alco plant, modern diesel-electric locomotives roll off production lines to help the railroads shoulder the extra burden of today's traffic—traffic essential to both industrial strength and defense. In the same city, but in a completely independent, modern plant, Alco's Ordnance Division turns out the Army's new Patton tank with the backing of a network of more than 1,500 subcontractors.

Side-by-side output of industrial and military goods is typical of other Alco plants, too—and industry in general. America grows stronger as these production lines move forward together.

AMERICAN LOCOMOTIVE COMPANY

CLEVELAND tapping machines *lead screw*



When Every Hour Counts...Rely on CLEVELAND

Production hours saved can become pretty important in a defense program...and Cleveland Tappers save production time... turn out more perfect pieces per hour. They cut tapping costs by combining operations...turn semi-skilled workers into skilled operators. Cleveland engineers can design a machine for your needs which will not only combine several operations but also tap groups of holes at one stroke of the machine. If you have a production problem check with Cleveland FIRST.

A CLEVELAND TAPPER set up on a munitions job, tapping a 1 15/32", 16-pitch Buttress thread in SAE 4143 steel tubing hardened to 35 to 37 Rockwell.

Cleveland offers all these features

- Precision hardened and ground lead screw.
- Fully automatic or manual control.
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- Heat treated alloy steel spindles for maximum strength.
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- Positive coolant and lubricant supply under constant control of operator.
- Rigidly constructed to give years of service.
- Maximum safety for operator and machine.

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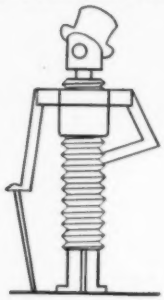

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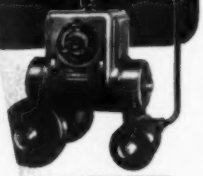

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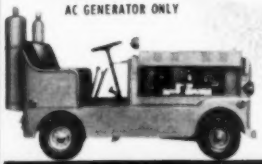

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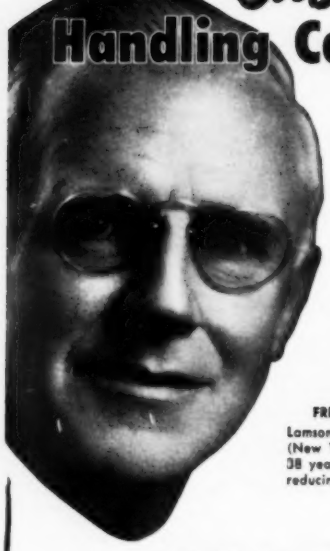

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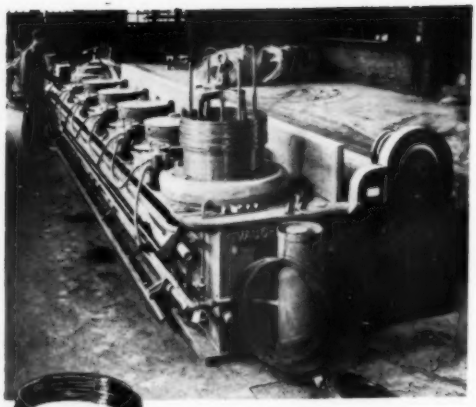

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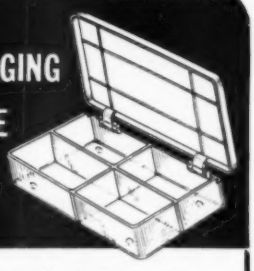

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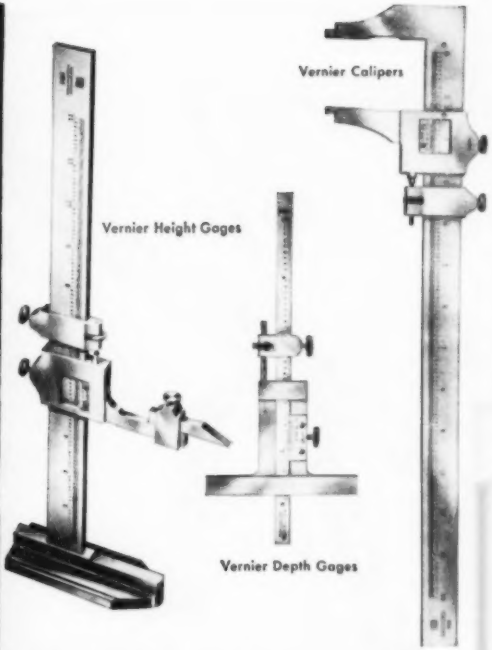

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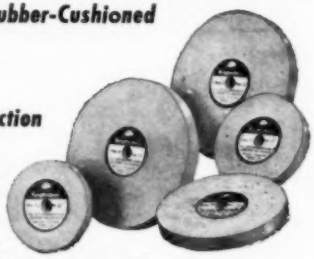

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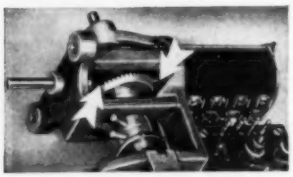

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INDEX TO ORDNANCE VOLUME XXXV

The Index to Volume XXXV of ORDNANCE, with title page for binding, is now available. It will be sent free of charge upon request to the Editorial Offices at the address below.

It covers subjects in the following 1950 and 1951 issues: July-August (No. 181), September-October (No. 182), November-December (No. 183), January-February (No. 184), March-April (No. 185), and May-June (No. 186). It is arranged alphabetically by subject and author.

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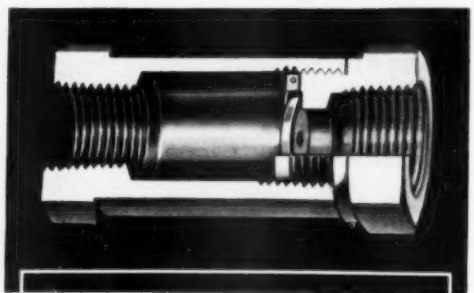

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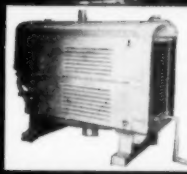

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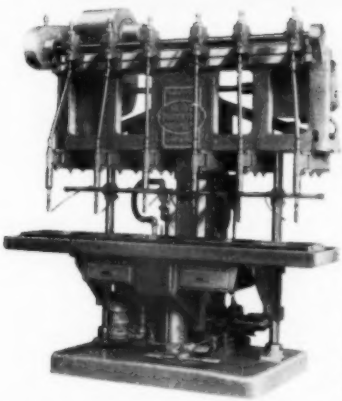

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	Page
Acetogen Fabricators, Inc.	379
Advance Die & Tool Company	359
Aerial Products, Inc.	484
Aetna-Standard Engineering Company	481
Aircraft-Marine Products, Inc.	354
Allied Research Products, Inc.	448
Aluminum Company of America	331
Alvey-Ferguson Company	434
American Chain & Cable Company	464
American Chemical Paint Company	426
American Locomotive Company	471
American Machine & Foundry Company	377
American Steel Foundries	338
Anchor Post Products, Inc.	344
Ansul Chemical Company	386
Arma Corporation	382
Armstrong Cork Company	477
Arnold Engineering Company	384
Atlas Powder Company	464
Bell Telephone Laboratories	361
Bendix Aviation Corporation	373
Berkman Company, L., Fort Pitt Steel Division	452
Blaw-Knox Company	341
Bohn Aluminum & Brass Corporation	439
Bowser, Inc.	444
Bradford Machine Tool Company	391
Breeze Corporations, Inc.	335
Brown & Sharpe Manufacturing Company	477
Buffalo Forge Company	468
Bundy Tubing Company	383
Burgess-Norton Manufacturing Company	473
Caterpillar Tractor Company	380
Chase Brass and Copper Company	449
Chrysler Corporation	437
Cleveland Container Company	466
Cleveland Tapping Machine Company	472
Clipper Manufacturing Company	442
Clover Manufacturing Company	430
Conmar Products Corporation	425
Connecticut Hard Rubber Company	451
Conner Tool & Cutter Company	430
Consolidated Vultee Aircraft Corporation	333
Continental Motors Corporation	427
Continental Screw Company	431
Crown Cork & Seal Company	360
Danly Machine Specialties, Inc.	371
Daystrom, Inc.	350
Delco Radio Division, GMC	364
Detroit Aluminum & Brass Corporation	460
Dicks Company, C. O.	455
Du Pont de Nemours & Company, E. I.	IV Cover
Eastern Air Devices, Inc.	466
Eastman Kodak Company	445
Eaton Manufacturing Company	474
Eberhard Faber Pencil Company	440
Evans' Sons, Inc., John	462
Everedy Company	462
Exact Weight Scale Company	476
Fabricated Products Company	467
Fairchild Camera & Instrument Corporation	480
Fairchild Engine & Airplane Corporation	348, 453
Fedders-Quigan Corporation	454
Fellows Gear Shaper Company	476
Flexible Package Company	444
Food Machinery & Chemical Corporation	461
Fruehauf Trailer Company	346
Fuller Brush Company	464
Gear Grinding Machine Company	358
Gilbert Plastics, Inc.	476
Gits Brothers Manufacturing Company	332
Gray Manufacturing Company	330
Great Lakes Steel Corporation	349, 357
Greenfield Tap & Die Corporation	375
Grip Nut Company	450
Gulf Oil Corporation	480
Hall Engineering, Gale	473
Hays Manufacturing Company	352
Heckethorn Manufacturing & Supply Company	356
Heil Company	465
Heli-Coil Corporation	468
Hobart Brothers Company	472
Hobart Manufacturing Company	362
Hydraulic Press Manufacturing Company	387
Hyster Company	389
International Nickel Company	457
Kelsey-Hayes Wheel Company	376
Kent-Moore Organization, Inc.	II Cover
King-Seeley Corporation	465
Kohler Company	480
Koppers Company	334
Lamson Corporation	474
Leake Stamping Company	366
Link-Belt Company	368
Lucas-Milhaupt Engineering Company	478
Luria Engineering Corporation	370
Markem Machine Company	454
Mason & Hanger Company	466
Matthias Paper Corporation	477
McCord Corporation	454
Minneapolis-Moline Company	481
Morse Chain Company	469
National Broach & Machine Company	355
National Radiator Company	436
Neilson Chemical Company	467
New Departure Division, GMC	372
Niagara Blower Company	462
O & S Bearing Company	388
Oakite Products, Inc.	339
Olin Industries, Inc.	470
Parker Rust Proof Company	465
Pemco Corporation	475
Pennsylvania Salt Manufacturing Company	336
Plan-O-Mill Corporation	351
Precision Castings Company	435
Pressed Steel Car Company	340
Reading Tube Corporation	447
Remington Arms Company	478
Remington Rand Inc.	378
Reo Motors, Inc.	456
Rheem Manufacturing Company	479
Rhodes, Inc., M. H.	478
Roberts Rubber Company, Weldon	479
Rockwell Manufacturing Company	432
Root Company, B. M.	481
Ross Engineering Corporation, J. O.	479
Scaife Company	363
Seamless Rubber Company	475
Shafer Bearing Corporation	438
Sheffield Corporation	347
Shellmar Products Corporation	458
Silent Glow Oil Burner Corporation	337
Simonds Abrasive Company	446
Sperry Gyroscope Company	433
Spicer Manufacturing	429
Standard Products Company	365
Standard Steel Spring Company	342
Standard Tube Company	390
Stewart-Warner Corporation	463
Sun Electric Corporation	367
Superior Foundry, Inc.	391
Texas Gulf Sulphur Company	467
Timken-Detroit Axle Company	385
Timken Roller Bearing Company	III Cover
Titeflex, Inc.	369
Tube Reducing Corporation	353
Tubing Appliance Company	446
Underwood Corporation	428
United Chromium, Inc.	459
U. S. Steel Corporation - National Tube Company	470
Watson-Stillman Company	345
Wirebound Box Manufacturers Association	374
Wolverine Tube Division	443

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ARMAMENT TECHNOLOGY

This section of ORDNANCE contains articles of a detailed and technical nature on ordnance research, development, manufacture, field use, and related subjects.

New Trucks for Old

Ordnance Assembly Line Rebuilds Vehicles in Japan

Brig. Gen. Gerson K. Heiss

Ordnance Officer, Japan Logistical Command

IT was pointed out in the preceding article (September-October issue, p. 242) that the pressure exerted on the armed services for the immediate return of all military personnel from overseas at the end of the Second World War had stripped the Army of the manpower needed for an orderly and efficient cleanup of our far-flung bases.

A Saving Rôle

Automotive vehicles by the thousands, together with tons of spare parts, had to be left on Pacific islands as mechanics and supply specialists were summarily returned to the United States and demobilized. However, this same matériel left in the Philippines, on Guam, Saipan, Okinawa, and other Pacific bases in 1945 has played a strangely prominent and, perhaps, a saving rôle in the logistic support of the United Nations forces in Korea in 1950 and 1951.

As late as January 1950 the Army still was being severely criticized in various magazine articles and news stories for what appeared to be a large-scale waste of matériel. However, long before this, plans had been laid and were being carried out for the recovery and rehabilitation of most of the automotive equipment that had been previously abandoned.

This operation was designed to accomplish three things: to save the American economy and taxpayer millions of dollars by providing the Army, through rebuild, with sorely needed vehicles at a minimum cost; to assist the Japanese economy by providing work for thousands of idle Japanese workmen; and, as history unfolded in Korea, to provide United Nations forces with vehicular support at a time when it was vitally needed and was not available from any other source.

The program got under way when, from collection points in the Pacific islands, vehicles were rounded up for transport to Japan. For the most part this was accomplished on ships belonging to the United States but manned by Japanese seamen. Approximately 63,000 automotive vehicles were thus collected and brought to 3 open storage areas in Japan. While these storage areas were located at some distances from the ports, the efficient canal system of Japan simplified transportation by means of old-fashioned wooden barges.

As they began to build up, these storage areas presented an amazing panorama, almost as far as the eye could see, of rusted, twisted, and broken vehicles, seemingly beyond any rehabilitation.

In addition to rounding up tens of thousands of such vehicles, the automotive roll-up also included countless tons of assemblies and parts. They, too, were received in all stages of deterioration.

Plants Converted

Meanwhile, Japanese plants and shops, previously devoted to production for war against the United States, had been converted for the job of rebuilding these vehicles. These plants and their machinery were sparked with American supervision and know-how. Mass-production methods were

CONTENTS

New Trucks for Old 485
Brig. Gen. Gerson K. Heiss
Rebuilding vehicles in Japan

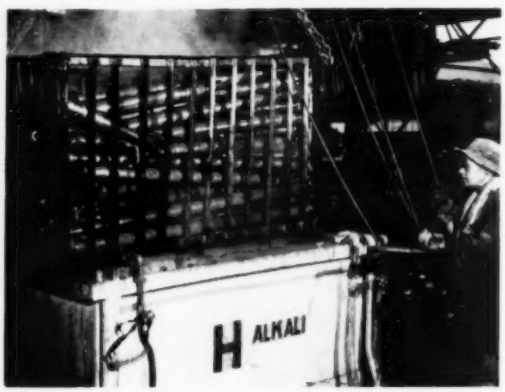
Ordnance Gage Procurement .. 490
Lieut. Col. W. P. Hersey
A district office task

Confederate Handguns 493
W. A. Albaugh, III
New details on old pistols

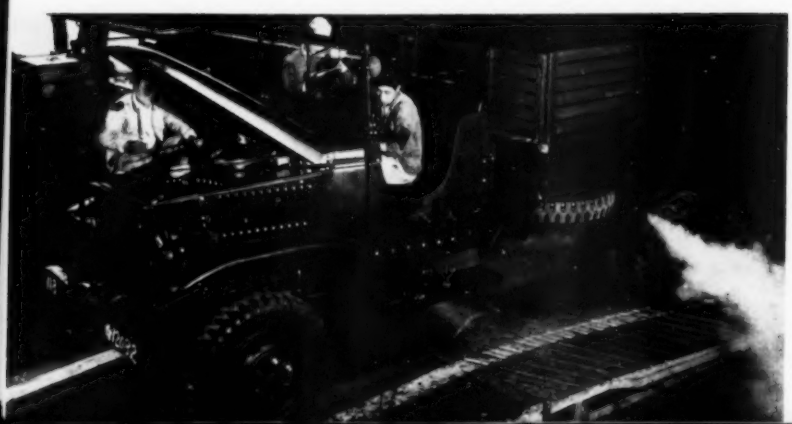
Logistical Commands 502
Lieut. Col. J. W. Schroder
How to save manpower

Collected from outlying Pacific islands, these battered relics of World War II arrive at the reconditioning center on Japanese barges. From wrecks like these, completely rebuilt vehicles will be created and commissioned for Korean service.

The reconditioning process begins as assembly from an unserviceable truck, and each part repaired, rebuilt, and

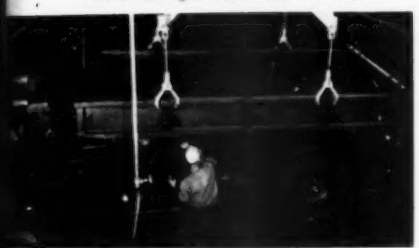


Rescued from derelict vehicles, usable driveshafts are chemically cleaned, above, before entering the main assembly lines. At right, reclaimed nuts and bolts are placed on a conveyor belt for sorting by Japanese women. Below, a completely reconditioned vehicle moves off the assembly line under its own power.



Japanese mechanics remove the engine The engine then will be broken down reassembled in running condition.

Pistons, valves, and connecting rods are fitted and assembled to engine blocks salvaged from old vehicles.



Above, a truck body is fitted into position. Below, the finished product—1,100 reclaimed U. S. Army trucks.

introduced and taught to the abundant skilled Japanese labor that was available.

The rebuild program is based upon the concept of a complete assembly-line operation. Both the salvaged vehicles and the salvaged assemblies are completely broken into separate components. As they are broken down they are inspected, segregated, and identified. Then each component is given a thorough cleaning, either chemically, mechanically, or by hand. This includes the removal of accumulated rust in most instances. This treatment applies to the smallest nut or bolt as well as to such larger parts as hoods, fenders, axles, and body parts.

The next step is the repairing of each part, including remetalizing, if necessary. The final step is storage before movement to the assembly line.

Engines Rebuilt

While the basic principles of the operation have been the same for all components of a motor vehicle, the engines, as well as certain other major assemblies, are rebuilt at a separate plant. In most cases engine rebuild requires cylinder reboring or resleeving. Pistons, connecting rods, and crankshafts must be refinished and balanced with matched sets of pistons and connecting rods fitted to each engine block. All rebuilt engines are checked by dynamometer tests during which they are run under load on test stands for a minimum of two hours while all components are checked.

Assemblies, such as carburetors, pumps, starters, generators, distributors, axles, transmissions, transfer cases, etc., are reconditioned on a mass-production scale in a similar manner.

Radiators are disassembled and all copper tubes, fins, and tanks are straightened and repaired. They are then reassembled, soldered, and finally pressure-tested for leaks.

All wooden components, including floor boards and bodies, are newly manufactured from hardwood procured either in Japan or the Philippines.

The above examples are just a cross section of components that require varying degrees of reclamation and rebuild. They represent only a fractional part of the total.

Many parts which would normally be considered beyond economical repair in the United States can be salvaged for further use in Japan because of the wide difference in labor costs. For example, hydraulic master cylinders and wheel cylinders for the brake systems are reclaimed by sleeving and polishing to original factory tolerances.

Parts Repaired

Transmission shifter forks are built up by welding and are then turned and ground to original factory tolerances. Worn flanges on transmissions, axles, pillow blocks, and transfer cases are first turned down on a lathe, then built up by metalizing, finally being turned and ground to original sizes and smooth finish.

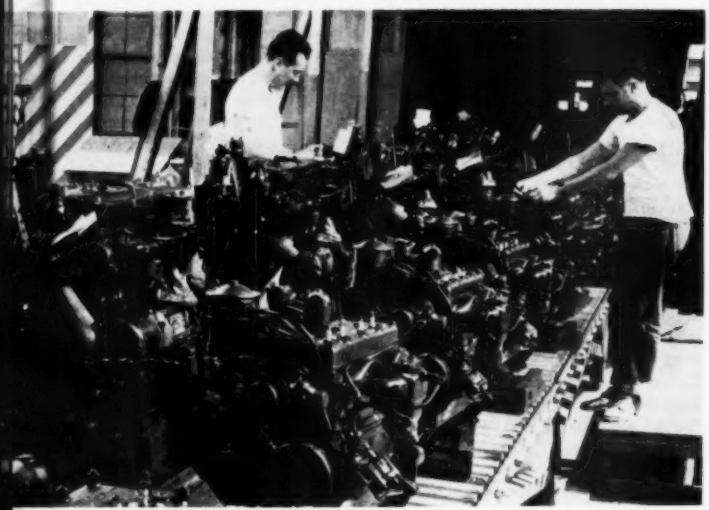
One of the outstanding features of the rehabilitation program has been the reconditioning of tires. It was discovered to our amazement that tires, already well worn at the conclusion of World War II and subsequently left on vehicles in all kinds of weather and climatic conditions from four to six years, could be economically reconditioned with long-life prospects. After removal from wheels, the reprocessing of tires includes buffing, section repairs, application of camelback, and molding of the new tread.

To obtain the desired volume of vehicle production has required a very careful scheduling of the movements of parts and assemblies from four separate sources (that is, from rebuild and reclamation, manufacture by assembly plants in separate shops, procurement of certain items from Japanese industry, and shipment of certain other items from the United States). Timed phasing had to be worked out so that necessary items would reach the assembly line in proper sequence and quantity.

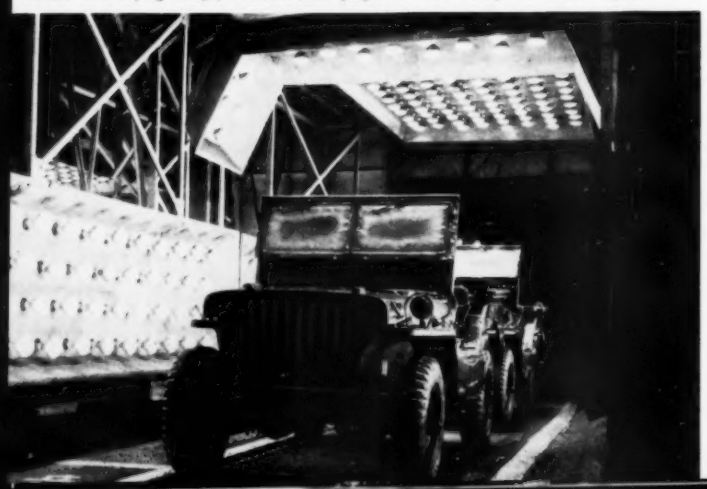
44,000 Items

The magnitude of this job can be appreciated when it is realized that there are 44,000 different items needed to assemble the many different types of military vehicles rebuilt under this program. In order to allow time for parts being shipped from the United States—which naturally takes much longer than those received from reclamation, local procurement, or plant manufacture—thousands of items must be scheduled at least six months in advance of the day the vehicle starts down the final assembly line.

Beaten, broken, bent, and battered, these jeeps, old war horses of World War II, are towed to the reconditioning shops whence they will emerge ready, willing, and able for service once more—with great savings to the American taxpayer.



American automotive inspectors, above, make a final check of the rebuilt engines as they roll off the production line in Japan. Below, their new paint gleaming under the drying lamps, reconditioned jeeps roll out ready for action again.



Armament Technology

Since no two vehicles have the same identical mortality on parts, the scope and magnitude of the staff work that is necessary to keep the production lines operating and at the same time prevent an overstockage of parts can readily be appreciated.

Mass Production

All the component parts flow to the master assembly line where they are assembled in an operation that is commonplace to Detroit but utilized for the first time on such a scale in the Far East. In fact, the operation has no real counterpart in the world. Automotive mass production of vehicles in the United States is based entirely on new parts and assemblies.

In the Far East, while the basis of operation is the same, the sources of parts and assemblies are the unique ones that have been previously described.

The photographs accompanying this article indicate some of the lateral feeder lines for assemblies and parts that flow toward the main assembly line, with the right components arriving at the right place at the proper moment. At the end of the assembly line the vehicle's engine is started and the vehicle is driven away under its own power as Japanese technicians and inspectors make last-minute checks and adjustments.

Vehicles reach the end of the line at a rate as high as one every four minutes. After the final inspection and test run, the vehicles proceed to the paint shops for the final coat of olive-drab paint and from there to the modern infrared drying rooms that require only six minutes to dry the paint on the vehicles completely.

Know-How Supplied

The American mass-production techniques and technical supervision that have transformed Japanese plants and "piecework" procedures into assembly-line production are being furnished by 51 Ordnance officers, 284 Army civilians, and over 500 enlisted men of the Ordnance Corps.

The importance of this logistic support to our forces in the field has been inestimable. Of almost equal importance has been the saving in money and in strategic materials represented by these vehicles. A new jeep pur-

Worn tires for trucks and jeeps can be reconditioned in many cases to give a great deal more mileage. In the photo above, skilled Japanese workmen are shown buffing tires in preparation for the retreading process.

Above, reconditioned tires await assembly to the rebuilt vehicles at the Oppama Ordnance Depot in Japan. Equipped with such tires, the jeeps below are ready for shipment to Korea where they have been rendering yeoman service to our troops.

chased in the United States today costs approximately $2,000. Jeeps rebuilt in Japan from World War II vehicles cost about $800 each. New cargo trucks cost approximately $6,000. Rebuilt cargo vehicles of similar capacity in Japan cost around $1,560. In addition, the savings in transportation and ship tonnage from the United States have been appreciable.

65 Per Cent Rebuilt

Over sixty-five per cent of all transport vehicles in Korea that are hauling ammunition, rations, and other necessary supplies to the fighting forces have been processed through the rebuild plants. These vehicles were delivered to the United Nations forces fighting to stem the Communist aggression in Korea when replacement vehicles were readily available from no other near-by source.

No one individual or group of people can be singled out as being responsible for the successful accomplishment of this vital program, but it has been one of teamwork by all concerned. The entire project is an integral part of the Japan Logistical Command, under the command of Maj. Gen. Walter L. Weible.

This is the second in a series of three articles prepared by Brig. Gen. Gerson K. Heiss, Ordnance Officer, Japan Logistical Command and commanding general of the 229th Ordnance Base Depot. The articles describe the organization, development, and success of a unique Ordnance operation in providing a major part of United Nations support for the Korean conflict.

General Heiss, a native of South Carolina and a graduate of Clemson A. & M. College, was with the Office of the Under Secretary of War at the outbreak of World War II. His later wartime assignments included experience in North Africa and in the Office of the Chief of Ordnance. At war's end he was Executive, Office of the Under Secretary of War, continuing in a similar position until 1950 when he assumed his present position.

The Japan Logistical Command was established on August 25, 1950, to provide support for the Korean conflict and for occupation duties. Born under the pressure of war, it has achieved an outstanding record.—The Editors.

Ordnance Gage Procurement

A Vitally Important Function of the District Offices

Lieut. Col. Winthrop P. Hersey

Ordnance Corps, Boston Ordnance District

"The key to successful gage procurement is a thorough and up-to-date knowledge of available manufacturing capacity. This can only be acquired by repeated personal visits on the part of experienced gage engineers."

IN dollar value the contracts placed and administered by an Ordnance district for the procurement of Government inspection gages are generally a very small percentage of the district business. In importance to the production of Ordnance matériel, however, the availability of well-designed, correctly made gages—on time—is a matter of first importance.

Not Routine

It might also be assumed that gage procurement is in the nature of a routine operation. Nothing could be further from the truth, especially during a national emergency. Because of the fact that the great majority of Government inspection gages are special, their purchase requires the services of personnel who are themselves familiar with gage production and who have up-to-date knowledge of the facilities with which they are doing business.

The well-integrated district gage organization will include the following activities: procurement of gages and measuring equipment; operation of the district gage laboratories; and gage repair and modification.

It will also provide for care of Government-owned gages and measuring equipment in the district, except when in field use by inspection personnel; gage surveillance; and the requisitioning of inspection gages from the arsenals.

Important Activities

Gage facility surveys and the maintenance of up-to-date information regarding sources of supply for both manufacturing and inspection gages are other important district activities, as well as assistance to Ordnance contractors in gage design, gage procurement, and the use of gages and measuring equipment.

Within the district, the gage organization may be located in the industrial division, the inspection division, or perhaps elsewhere, but one primary objective should be remembered: the gage activities should be located in *one* place under *one* head. The problems of procurement, supply, checking, and surveillance of inspection gages are so interrelated and of such a specialized nature that a unified gage organization is essential to efficient operation.

At the opening of the Second World War, different segments of gage activities were scattered among the several divisions and branches of the district offices. Toward the end of the war many districts had drawn together all of these parts into one central group, and it was this type of unified gage organization that did its job most successfully.

Same Principle Applies

The same principle applies in the present emergency, and it is those districts which are farthest along toward unified gage operation that are going along with the least interruptions and lost motion.

Let us now consider briefly the method of operation of the gage-procurement activity. For purposes of convenience we will divide this into four general categories: survey and classification of gage-manufacturing facilities, including reporting of available capacity; negotiation of the procurement; production; and gage repair and modification.

The key to successful gage procurement is a thorough and up-to-date knowledge of available manufacturing capacity. This can only be acquired by repeated personal visits on the part of experienced gage engineers.

Smaller Shops

The large, long-established manufacturing concerns are well known as to equipment, capabilities, and products. It is the smaller shops that must be utilized to the fullest extent in an emergency since the larger ones soon become heavily loaded. Some districts, through their small-business activities, have been doing a very thorough job of digging out new gage facilities from among the small tool and gage shops, with excellent results.

Thus it is possible to spread the work among a comparatively large number of small manufacturers. It is of the utmost importance that these small shops be carefully searched out and surveyed by competent engineers and their potentialities recorded. For this purpose, a special survey form is advisable.

We are interested principally in three things: (1) finishing equipment such as surface grinders, cylindrical grinders, etc.; (2) measuring equipment; and (3) experience in gage manufacturing. These qualifications should be checked and reported in detail since they determine whether or not a plant is qualified to produce Ordnance gages.

If the facility is not considered suitable for gage work, it is so advised and told why. Recommendation is also

made, if requested, concerning what type of Government work it should attempt to obtain. Should the facility be considered a suitable source for Ordnance gages, it is entered on the district office list of approved gage manufacturers for the particular type it can produce and is given an opportunity to bid on future requirements.

Method Reviewed

Should the first bids be way out of line, the method of pricing is reviewed by a gage engineer and assistance rendered in methods of estimating. Pricing of special gages is a most difficult task, and few gage manufacturers have the time or personnel to undertake it in a systematic manner.

Names of approved gage producers are sent by the district office to the Frankford Arsenal Gage Department, together with recommendations as to types of gages they can manufacture and approximate delivery dates. These data are then included in a publication outlining available gage capacity by districts and circulated to Ordnance establishments throughout the country.

Periodically each district is requested by Frankford Arsenal to report on each gage manufacturer in the district as to the type of gage he can make and his presently quoted deliveries. This can only be accomplished by firsthand contact, but the result is an accurate picture of the current gage capacity on a nationwide basis.

Procurement Procedure

Having obtained accurate information concerning our gage manufacturers, we now proceed to use it in our procurement procedure. Ordnance districts purchase few gages for their own use; this is an arsenal responsibility. District offices actually operate as purchasing establishments for the arsenals on the sound theory that they are close to the contractors and in the best position to carry on firsthand negotiation and production with their manufacturers. Therefore the procurement directives proceed from arsenal to district on one of two bases: (1) They request districts to obtain prices and submit them to the arsenals for evaluation; (2) They direct allocation to a particular district to obtain the material required on the best terms. Usually estimated costs are also furnished.

The first of these methods has not been entirely successful because it results in many gage manufacturers throughout the country spending valuable time in estimating prices, and bidders cannot hold capacity open for the time required to gather prices from several districts, evaluate them, select the best proposal, and make the award.

Direct allocation to the districts proved most successful in World War II and is being used by some arsenals at present. Where adequate competitive capacity exists, this policy is authorized by the Ordnance Corps under OCTI 400-1-51.

Qualifications Checked

Upon receipt of procurement directive, with necessary drawings, gage engineers look over the prints and determine which manufacturers are best qualified to do the particular job. These men have seen every plant on the approved list and are in the best position to select bidders. From three to six proposals are usually sent out, since at least three competitive prices are desirable. *Never* send a request for a proposal on gage work to a new firm until the plant has been surveyed and approved; it is asking for trouble both for the Government and the contractor.

The Ordnance Corps is extremely fortunate in having officer and civilian personnel available, who know the intricate details necessary for a successful gage program. The younger officers and civilians trained during World War II have reached the age of discretion; with their technical and procurement background gained in the past they will assure getting off to a logical start in this emergency without having to go through the trial-and-error stage attendant upon a major effort of this type.

It would indeed be a step forward if all Ordnance Districts could organize their gage activities along the same lines and operate with a somewhat similar procedure. One of the difficult problems is gage repair and modification. A standard contractural procedure, similar to that used during World War II, should be initiated immediately.

Colonel Hersey's article provides a pattern, based on experience, which should save the most valuable asset in any emergency—time.—COL. HARRY B. HAMBLETON, *Chief, Gage Division, Ordnance Department, United States Army, during the Second World War.*

Personal Attention

It is often necessary to follow written requests for proposals with telephone calls to see if bids will be forthcoming, and personal visits are many times necessary. After receipt of proposals, the successful bidder is selected upon consideration of the following factors: price, delivery, ability and experience. All three are equally important.

Justifying gage prices, where each item is special and there is no yardstick for comparison, is a difficult problem. It is strictly an engineering job, and must be done by men who have themselves made gages for many years.

Every effort is made to make awards and get contracts out as quickly as possible. Streamlined procedures will be necessary in the district office, and to this end a "Progress of Negotiations" wall chart is very helpful. It shows clearly which of the procedures are taking too much time, as well as giving a visible report on the status of any particular job on a given date.

After the contract has been awarded and the directing arsenal notified, the gage-production group comes into the picture. A visit is made to the contractor's plant promptly to be sure he understands all details of the contract, especially delivery dates and packaging instructions. Thereafter, weekly visits are made to check on contractor's progress, making a physical check of the gages, if possible. When required, assistance is given on subcontracting problems, and engineering service is always available. This last is very important, since problems in connection with the design of gages are constantly coming up, and modifications often must be made during progress of the work.

Constant Contact

To this end the district gage engineers are constantly in contact with the arsenal gage personnel. Here it should be emphasized that all changes, clarifications of dimensions, etc., between the Government and its contractors must be confirmed promptly in writing and the information made part of the contract folder in order to avoid

and misunderstandings at inspection.

As changes occur in delivery schedules, due perhaps to manufacturing problems or specification revisions, the directing arsenal should be promptly advised so that its records may be up to date. This is vital, inasmuch as somewhere a production line may be rolling, and the gages must be there on time.

Inspection and acceptance of gages may be at the directing arsenal or at the district gage laboratory. In either case a follow-up must be maintained to see that inspection is made promptly and rejections, if any, corrected and returned without delay. Upon receipt of acceptance report, contact is made with the Finance section to assure prompt payment. Since most gage contractors are small manufacturers, it is most important that they be paid promptly.

In this respect, delays in fiscal papers, availability of funds, or other controllable causes either on the part of the districts or of the directing arsenals should not be tolerated. The responsibility of the gage-production group does not end until final payment is made.

Gage Repair

A little-known but very important function performed by the Ordnance district gage organization is the repair and modification of Government inspection gages. Like any other expendable equipment, gages become worn. Also, due to component changes, they must continually be revised.

Gage repair presents a difficult problem for two reasons: Only the most skillful gage manufacturers are capable of correctly repairing or modifying Government inspection gages, and it is impossible in most cases for the contractor to determine with any accuracy the amount of time he will require to repair a particular lot of gages until he is well into the work of disassembly and inspection. Therefore it cannot be done fairly under a fixed-price type of contract.

To meet this situation the Ordnance Corps has developed a special type of time-and-materials contract. Under this contract the manufacturer will be paid at a predetermined hourly rate for time expended in the disassembly, inspection, and repair of gages provided the number of hours expended are approved as reasonable by the contracting officer acting on the report of a qualified gage engineer and are found by Army audit to have been applied to the particular job.

Coöperation Needed

To operate successfully, such a contract must have complete understanding and coöperation between the district office and the contractor, and great care must be used in the selection of manufacturers with which such contracts are made.

Gage repair and modification are now being carried on much more extensively, at least in some districts, than at any time in the past for one particular reason: At the end of World War II, several hundred thousand Government inspection gages, both standard and special, were placed in war reserve by farsighted Army Ordnance officers. Thousands of these are now being modified to meet design changes and quickly placed in the hands of Government inspectors.

Replacement of these gages would cost millions of dollars and take years of valuable time. They are today being modified and made serviceable at about one-tenth of their replacement cost.

Subsequent to the First World War, a number of Ordnance gage laboratories were established in educational institutions in the different Ordnance districts. These laboratories were operated by Army Ordnance personnel with excellent results during World War II, and thereafter twenty-eight gage laboratories were again set up in various universities, using the valuable measuring equipment acquired during the war years.

Peacetime Training

Under the terms of the agreements, the institutions make use of these laboratories in peacetime for the training of students, maintaining the equipment in good working order at all times, and they are available for the training of Ordnance personnel. In a national emergency, the Government may take over and operate these laboratories. This step was initiated in 1940 and again late in 1950. At present, therefore, there are one or more well-equipped gage laboratories operating in each Ordnance district.

The principal object of the district gage laboratories is to permit the maintaining of Ordnance inspection gages in first-class condition. In short, it is a service to inspection.

No article covering district gage operation would be complete without at least a mention of the expansion of gage-manufacturing facilities. While conditions in the gage industry, as this is written, do not appear to warrant a general expansion, a very extensive program was carried on during the Second World War and could again become necessary should conditions require it. At the start of World War II, gage productive capacity was estimated at approximately five million dollars a year. By means of the gage-expansion programs carried on under Ordnance direction, this capacity was increased to one hundred and fifty million dollars a year at its peak in 1944.

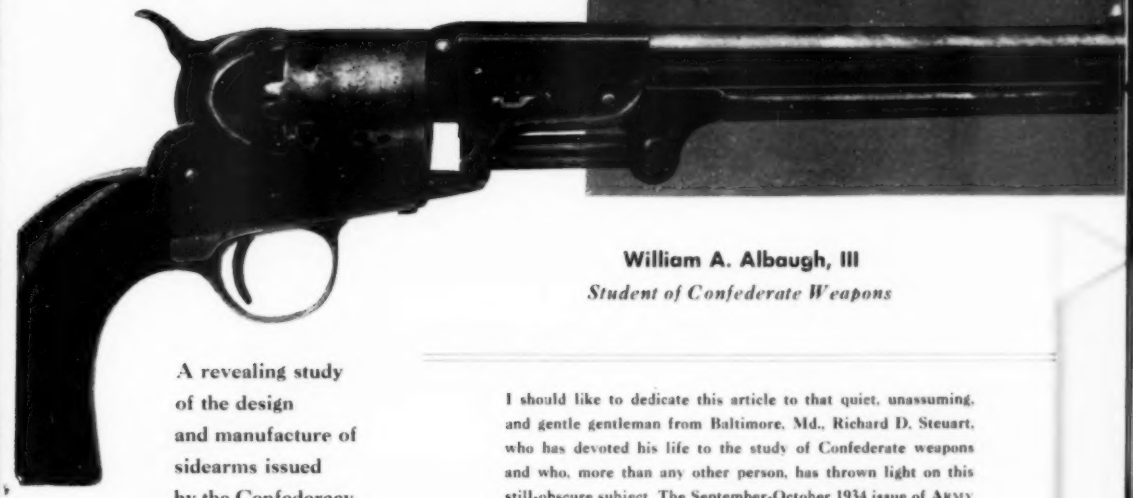
Equipment Furnished

Under the Ordnance gage-expansion programs, necessary gage-manufacturing equipment was furnished by Army Ordnance to carefully selected gage manufacturers to supplement facilities already existing. This equipment was supplied on a lease basis, and most of it subsequently was purchased by the gage manufacturers themselves. In such a program the selection of facilities, procurement of equipment, and supervision of its use fall on the district gage personnel.

The success of the national Ordnance gage program lies in the fact that it has been maintained as an integrated, continuous activity since World War I. The arsenal and district gage laboratories serve as instruction centers for Ordnance personnel in peacetime as well as in emergencies.

Continuing advice and active assistance from the Gage Industry Division of the American Ordnance Association has been and is now of inestimable value in determining such basic facts as the general over-all gage production capacity of the Nation and sources of supply for special types of gaging equipment. Through the A. O. A., the gage manufacturers have made available to Ordnance the latest developments in new methods of gaging, a field in which great strides were made during and after World War II.

CONFEDERATE HANDGUNS



William A. Albaugh, III
Student of Confederate Weapons

A revealing study of the design and manufacture of sidearms issued by the Confederacy

I should like to dedicate this article to that quiet, unassuming, and gentle gentleman from Baltimore, Md., Richard D. Steuart, who has devoted his life to the study of Confederate weapons and who, more than any other person, has thrown light on this still-obscure subject. The September-October 1934 issue of ARMY ORDNANCE magazine carried an article by Mr. Steuart, entitled "The Story of the Confederate Colt," which is generally credited as the first of any scope on that subject.—W. A. ALBAUGH, III

ABOUT twenty-five years ago I purchased my first Confederate revolver. I recall it very well as a caliber .36, 6-shot, imitation Colt. It had a serial number which I do not recall, and no other identifying marks, save "C.S.A." stamped on the top of the barrel. A very unusual feature was that it had a nondetachable shoulder stock, something I have never seen on any other gun. Acquisition of this item turned my interest to the Civil War in general, and Confederate ordnance in particular.

Ordnance Slighted

Turning to the libraries at hand as the usual source of information, I was somewhat surprised to find that practically every phase of this war had been covered and recovered, with one lone exception—Confederate ordnance.

Using every possible combination of subtitles for this subject, I came up with only the following references: Gen. J. Gorgas, former Chief of Confederate Ordnance, "The Confederate Soldier in the Civil War," 1895; Richard D. Steuart, "Firearms of the Confederacy 1861-1865," *Magazine of Antique Firearms,* December 1911; Richard D. Steuart, "Where Johnny Got His Gun," *Confederate Veteran,* May 1924; Richard D. Steuart, "A Pair of Navy Sixes," *Confederate Veteran,* March 1925; and Richard D. Steuart, "Armories of the Confederacy," *Confederate Veteran,* January 1927.

In this list I do not include "The Long Arm of Lee," by Jennings C. Wise, published in 1915, as this very fine book deals mainly with artillery, and not with sidearms.

Little Detail

The above references were checked and rechecked. In the case of General Gorgas, he could and did speak with authority, but in covering as he did the entire picture of Confederate ordnance, and in an article of relative brevity, he dealt with little detail concerning the individual armories, arsenals, or the particular weapons which were made there.

Steuart's Articles

Mr. Steuart's articles were painstakingly compiled from newspapers of the war period, through firsthand accounts from survivors of the war, and from the bible of all Civil War historians—the Official Records of the War of Rebellion, which fill 130 volumes, printed by the U. S. Government in 1901. It is amazing that Mr. Steuart was able to obtain as much information as he did. While meager in comparison with what we know today, his writings have been the stepping stones for just about everything that has followed.

To get back to the Confederate revolver with the nondetachable shoulder stock: I recall that I bought it from a

local gun dealer for $15 and sold it shortly afterward for $25, well pleased with my profit. Very likely this gun was a Rigdon-Ansley revolver which, on today's market, would bring in excess of $300!

The Griswold & Grier

Before I entered Navy service in 1943, the brass-framed Griswold & Grier turned up regularly in Richmond priced at about $50. Upon my release to inactive duty in 1947, a fine specimen was offered me for $85. I turned this down thinking the price excessive. Shortly afterward I paid $175 for one in not nearly as good condition, for despite values quoted in various books on comparative gun values, the more or less accepted price of one on today's market is around $200, depending upon condition.

I mention these prices, not in an attempt to establish a market price for Confederate firearms, but to show the effect of knowledge and interest on supply and demand.

Why then this sharp increase in the demand for Confederate handguns? I believe the answer lies in several factors, not least of which is the enormous success of the late Margaret Mitchell's novel, "Gone with the Wind," which inspired interest in things Confederate ten years ago. The most important single factor however is unquestionably the book, "Firearms of the Confederacy," by Claude Fuller and Richard Steuart, published in 1944.

While this book leaves much to be desired, and many questions unanswered, it is the first entire publication devoted to the subject of Confederate guns and pistols. Prior to its publication few indeed were the persons who could distinguish between the brass-framed Spiller & Burr and the brass-framed Griswold & Grier.

Positive Identification

Through this book it is now possible to identify positively most of the Southern weapons, and a collector now can write to another with authority in identifying his collected items. Formerly a complete and lengthy description of the piece in question was necessary. Even then much doubt was left as to whether the gun was a genuine Confederate States item, or a made-over Colt.

The September-October 1934 issue of ARMY ORDNANCE carried a fine article entitled "The Story of the Confederate Colt," authored by Mr. Steuart. This was complete with pictures and was the first really comprehensive publication on this subject. Mr. Steuart traced the origin of the Confederate "Colt," beginning with one Charles H. Rigdon, a machinist in St. Louis, Mo., before the Civil War.

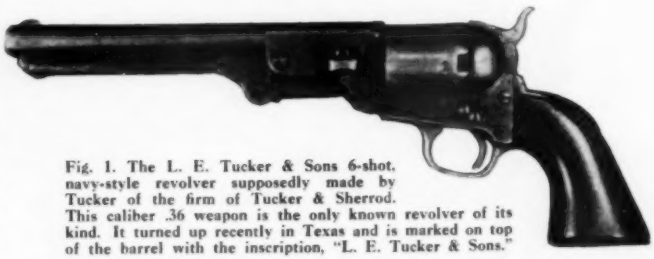


Fig. 1. The L. E. Tucker & Sons 6-shot, navy-style revolver supposedly made by Tucker of the firm of Tucker & Sherrod. This caliber .36 weapon is the only known revolver of its kind. It turned up recently in Texas and is marked on top of the barrel with the inscription, "L. E. Tucker & Sons."

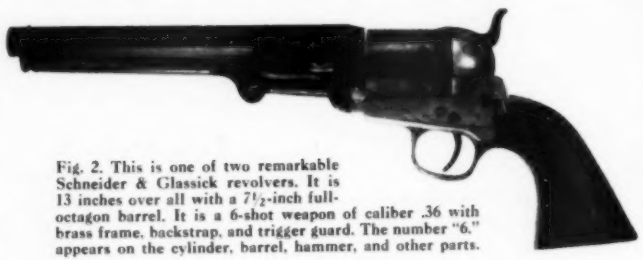


Fig. 2. This is one of two remarkable Schneider & Glassick revolvers. It is 13 inches over all with a 7½-inch full-octagon barrel. It is a 6-shot weapon of caliber .36 with brass frame, backstrap, and trigger guard. The number "6." appears on the cylinder, barrel, hammer, and other parts.

Imitation Colts

In St. Louis, at the same time, were H. E. Dimick, and the firm of Shawk & McLanahan, both engaged in arms making and, in particular, in the manufacture of imitation Colts.

The logical conclusion was reached that it was entirely possible and probable that Rigdon, who was later to become the foremost Confederate revolver maker, knew something of the methods of both Dimick, and Shawk & McLanahan, and that he profited by this association. In order to show the resemblance between the various guns, both the Dimick "Colt" and the Shawk & McLanahan "Colt" were pictured in the article.

This was unfortunate, for ever since then these two guns have been referred to as "Confederate." Actually they are both about as Confederate as a penny post card of Abe Lincoln! Any one who gives more than a passing thought to the matter must realize that a gun made by a Northern gunmaker prior to the time of the Civil War could not possibly be classified as Confederate. Desirable they may be as imitation Colts, but Confederate, no. This fable of seventeen years should be brought to a close.

With the beginning of the war, Dimick, and Shawk & McLanahan, sought contracts with the Federal Government to manufacture arms for the Union Army. Dimick successfully negotiated a contract, and spent the war helping the Union cause. On the other hand, H. Folsom, an associate of Dimick's and a Southern sympathizer, left St. Louis and went to New Orleans, opening a shop on Chartres Street. There he imported and made guns used by the Confederacy, and occasionally a pistol stamped "H. Folsom & Co., Chartres St., N.O." appears on the market. It is ironical that Folsom is now forgotten, while his "Yankee" associate Dimick is well known as a maker of "Confederate Colts."

The Confederate Colt

The knowledge of collectors was so limited that prior to the publishing of the "Story of the Confederate Colt," it was generally believed that the brass-

framed "Colt" was manufactured at various plants throughout the South, rather than all being the product of Griswold & Grier. Mr. Steuart credited the late Berkley Bowie with establishing this fact. Having been once established, it has narrowed down considerably the number of revolver factories which formerly were believed to have operated in the South. Also, as is true in everything else, once established, the fact is so simple that every one wondered why it took almost seventy-five years to discover!

Single Specimens

In the past few years a number of single specimen Confederate handguns have appeared. Time alone will tell whether these are "pilot models," or whether they are definite types. To mention one of these: The caliber .36 revolver stamped "Leech & Co., C.S.A." on the top of the barrel frame, similar in appearance to the Leech & Rigdon, serial No. 125 on all parts, no roller or cross-hatching on the hammer, and serial numbers a little larger than those of a Leech & Rigdon or a Rigdon-Ansley which are stamped on the left side of the trigger guard instead of underneath.

The rammer on this specimen has a latch wedge-shaped like on the Rigdon-Ansley, not like the Leech & Rigdon. Could this revolver have been made by Thomas Leech after he and Charles Rigdon parted company in 1863?

Rare Revolvers

Another revolver heretofore unknown is the one which recently turned up in Texas marked "L. E. Tucker & Sons," on the barrel top (Fig. 1). It is caliber .36, and is believed to have been made by the Tucker of Tucker & Sherrod.

Still another single specimen revolver is the caliber .36, marked "C. Rigdon." Is this for Charles Rigdon, and if so, when was it made?

In this same grouping, mention should be made of the 5-shot caliber .36 pocket-sized revolver with the flat recoil shield. Is this another example of the Dance Brothers?

In almost the same class is Schneider & Glassick, of Memphis, Tenn. This firm, whose name is occasionally found on deringers, is known to have had a contract with the Confederate Government for revolvers. However, after ninety years during which none of their revolvers had appeared, it was generally concluded that their contract had gone unfulfilled, with only one being made and causing the following article to appear in the Memphis *Daily Appeal* of December 8, 1861:

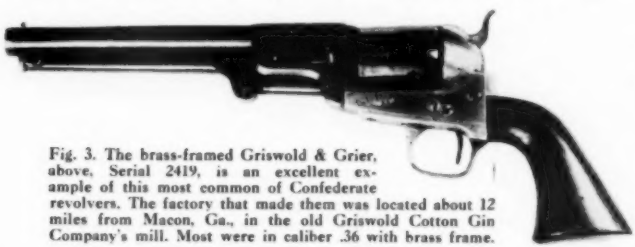


Fig. 3. The brass-framed Griswold & Grier, above, Serial 2419, is an excellent example of this most common of Confederate revolvers. The factory that made them was located about 12 miles from Macon, Ga., in the old Griswold Cotton Gin Company's mill. Most were in caliber .36 with brass frame.

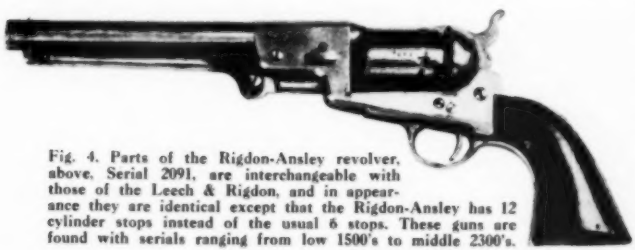


Fig. 4. Parts of the Rigdon-Ansley revolver, above, Serial 2091, are interchangeable with those of the Leech & Rigdon, and in appearance they are identical except that the Rigdon-Ansley has 12 cylinder stops instead of the usual 6 stops. These guns are found with serials ranging from low 1500's to middle 2300's.

"We were yesterday shown by Messrs. Schneider and Glassick, of Jefferson Street, between Front and Main Streets, a 6-shooter Navy pistol of their own manufacture. It is a beautiful weapon, not inferior to the Colt's make in any particular. The finish of the whole, the accuracy of the parts, and the excellent working of the mechanism are admirable. Iron, brass work, and wood work are all specimens of skill. We are proud that Memphis can turn out such splendid workmanship."

Schneider & Glassick

Now, oddly enough after the space of ninety years, not one, but two revolvers have appeared, both marked "Schneider & Glassick, Memphis, Tenn." These two have arrived on the scene within a year of each other, and, to add further confusion, each is entirely different from the other.

One is 13 inches over all with a 7½-inch full-octagon barrel, 6-shot, caliber .36, has a brass frame, backstrap, and trigger guard (Fig. 2). The number "6" followed by a period (doubtless to distinguish it from a 9) is found on cylinder, backstrap, trigger guard, barrel, hammer, and rammer. The original wedge has been replaced, but it, too, was probably numbered. There are no letters, inspector's marks, or subserials. The top of the barrel is marked "Schneider & Glassick, Memphis, Tenn." in one line, all from the same die (each letter is not stamped separately). Colt parts will not interchange; even the nipples have a different thread and are larger.

Unusual Safety

The second Schneider & Glassick (see top of page 493) closely resembles the Leech & Rigdon but has an unusual type of safety in that a notch in the hammer fits into slots between the nipples on the cylinder instead of the reverse, which is customary. This gun is stamped "Schneider & Glassick, Memphis, Tenn." on the top of the part-octagon barrel, the letters being stamped individually. The number "12M" is found stamped on various parts, and in one place is stamped "12Mdl" (for model?).

Now, obviously, between serial No. 6 and serial No. 12, the entire method of manufacture would not be changed

from a full-octagon barrel to a dragoon-type barrel and from a brass frame to an iron frame. Why then the difference? The answer probably lies in the fact that, while Schneider & Glassick held a Confederate contract, they did little or no manufacturing at all, but sublet to other local manufacturers who turned the finished product back to Schneider & Glassick. This name then was stamped on the barrel and the revolver passed on to the government.

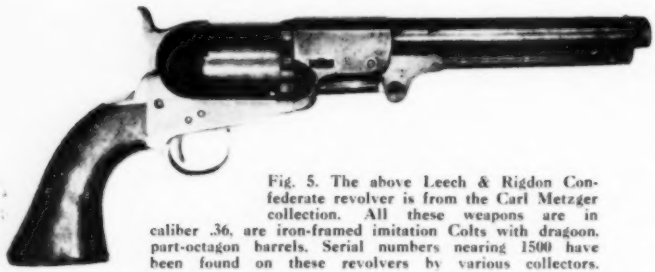


Fig. 5. The above Leech & Rigdon Confederate revolver is from the Carl Metzger collection. All these weapons are in caliber .36, are iron-framed imitation Colts with dragoon, part-octagon barrels. Serial numbers nearing 1500 have been found on these revolvers by various collectors.

A Third Model?

We now wonder to which of the two known specimens the newspaper article in the *Memphis Review* applied? It is even possible, if the above theory is correct, that the article referred to neither and that there is still a third model floating around somewhere.

Despite the various kinds and types of Confederate revolvers which are now turning up, the average collector can content himself with only a relatively few types, as the balance fall into the excessively rare American arms classification and are just not obtainable. The rarity of any gun can best be judged by the number made. Rarity, however, does not always determine comparative value.

Before considering the various handguns used by the South, let us first establish what is a Primary Confederate, a Secondary Confederate, and a Probable Confederate.

The classification is quite simple. A Primary Confederate firearm is one which was made under Confederate contract, by private contractor or by the government itself, to be issued directly to Confederate troops. A Secondary Confederate is one which might have been made for any purpose but which was purchased by the Confederate Government for issuance to its troops after it was made. A Probable Confederate is that which, through Southern markings or method of finding, one can be reasonably sure was carried by a Confederate soldier and used in the Civil War.

Thus, a Leech & Rigdon Confederate States of America revolver, made for the express purpose of use by the Confederate Army, is a Primary Confederate. The Virginia Manufactory pistol, which was armory-altered from flintlock to percussion for the express purpose of arming a Confederate soldier, is a Secondary Confederate. The Probable Confederate is, for instance, the Tranter revolver, stamped "T. W. Ratcliffe & Co., Columbia, S.C.," which was privately imported and which, while probably purchased and used by a Confederate soldier, could just as easily been bought by papa as a house pistol for mama while he was away fighting the war with a Colt!

Interesting Weapon

By far the most common of Confederate-made revolvers is the very interesting Griswold & Grier (Fig. 3). The revolver factory was located about twelve miles from Macon, Ga., at Griswoldville, Ga., in the old Griswold Cotton Gin Company's mill. It was organized by Giles C. Griswold, who died early in 1861, and operations were continued by his brother-in-law, Col. E. C. Grier.

Plant Burned

Revolvers were actually turned out early in 1862, for which Colonel Grier was paid $50 each by the Confederate Government. Although the plant was burned on November 20, 1864, by Kilpatrick's cavalry, a portion at any rate must have been rebuilt as mention is made of this revolver factory on February 21, 1865, in a letter from Gen. J. Gorgas ordering Col. James H. Burton to assume supervision over various Confederate armories.

All conform pretty much to the same style and type, being caliber .36, imitation Colt with dragoon-type barrel and brass frame. They are marked simply with the serial number which appears on frame, barrel, and cylinder. All other parts are marked with a secondary serial number, which is consistently found to be either the last number, the last two numbers, or the first and last number of the main serial.

Fig. 6. The Spiller & Burr shown above is from the Carl Metzger collection. This was a brass-framed imitation of the Whitney in caliber .36. About 1,500 of these revolvers were made, but they are a great deal less common than the Leech & Rigdon which might indicate that they were issued to infantry and not cavalry.

Unusual Markings

In addition to the serial numbers, of some seventy-five revolvers examined all bore a Roman numeral which was scratched on the underside of the trigger guard, on the underside of the brass frame, and the inside of the brass backstrap. Still another mark was found on all examined, this being a cryptic letter, or series of letters, such as an "R" backwards, an "S" back-

wards, an oddly formed "A," or a combination of such letters. This is found stamped on all major parts.

The serial number obviously applies to the number made, the secondary serial (since it always contains the same numbers as found in the serial) was stamped on all parts as belonging to that particular gun.

Casting Numbers

The Roman numerals, since they appear on the brass parts only, and have been found running only as high as XX, in all probability apply to a particular brass casting. The frame, backstrap, and trigger guard were all cast at the same time. Each mold would take about twenty castings before it was unfit for use and a new mold would have to be made. The cryptic mark is believed to be the inspector's mark.

Some of these guns are found with the part-octagon barrel, while others were made entirely round along the barrel top. The reason for this difference is not evident, and each are found in the high and low serial numbers. The part-octagon barrel is the more common, although few collectors place any difference in either one being more desirable than the other. These guns were made for cavalry usage, and, according to serial numbers, some 3,600 were made.

Leech & Rigdon

The next gun most frequently encountered is the Leech & Rigdon (Fig. 5), on which serial numbers have been found nearing 1,500.

The Ridgon of this firm is the same Charles H. Rigdon of St. Louis, Mo., mentioned earlier in this article. In 1862 he became connected with Thomas Leech, a former cotton broker of Memphis, Tenn., who in 1861 organized the "Memphis Novelty Works"—a sword manufactory. With the threatened fall of Memphis, the partners left that city, and, with their sword-making machinery, moved to Columbus, Miss.

Markings Changed

While it is possible that they made a few revolvers at this address, records do not so indicate. They remained in Columbus until December 1862 when they moved again, this time to Greensboro, Ga. It is believed that all the Leech & Rigdon revolvers are products of this plant. At first their guns were stamped simply, "Leech & Rigdon," but in March 1863, after securing a Confederate Government contract for the manufacture of their revolvers, their products were stamped "Leech & Rigdon C.S.A." This stamping appears on the barrel top. In April 1863 they discontinued sword making and turned all activities to the manufacture of their revolvers.

Like the Griswold & Grier, they, too, conform to type, all being caliber .36, iron-framed imitation Colts, with dragoon, part-octagon barrels. Practically every part is stamped with the serial number, and, as with the Griswold & Grier, a small cryptic mark can be found on each gun. Most frequently this mark is a cross, formed by four dots. Occasionally a "W" or some other letter is found stamped somewhere on the gun. The serial number is usually found penciled on the grip under the backstrap.

At least one Leech & Rigdon, has turned up bearing Rigdon-Ansley parts, and several have been found with no cylinder stop pins or slot in the face of the hammer to engage these pins, clearly indicating that little was thought of this form of safety and that the twelve-cylinder-stop form of safety must have been contemplated long before being put into practice.

Partnership Dissolved

While the partnership between Leech and Rigdon was dissolved officially in December 1863, this writer is of the opinion that they actually parted company prior to this date, although continuing the firm name.

Despite the fact that over 3,500 Griswold & Griers were turned out against some 1,500 Leech & Rigdons, the former appear more popular among collectors and, in a good many cases, have brought more in price than the latter. The writer has puzzled over this contrary fact, and the only reason that comes readily to mind is that usually each Colt collector (of which there are hundreds) demands one Colt imitation in his collection.

Heavy Demand

By far the most colorful of all Colt imitations is the Griswold & Grier with its showy brass frame which immediately sets it apart from all other "Colts." This might possibly account for the demand for the Griswold & Grier, although, certainly to the Confederate collector, the rarer Leech & Rigdon, which bears the firm name and "C.S.A.," is the more desirable.

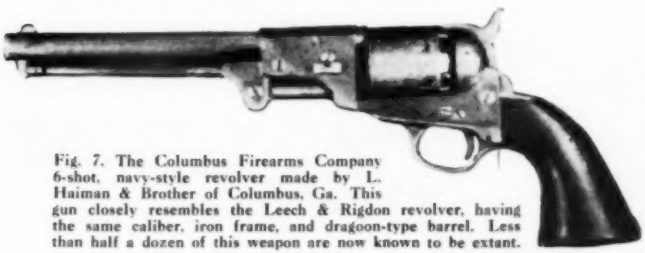


Fig. 7. The Columbus Firearms Company 6-shot, navy-style revolver made by L. Haiman & Brother of Columbus, Ga. This gun closely resembles the Leech & Rigdon revolver, having the same caliber, iron frame, and dragoon-type barrel. Less than half a dozen of this weapon are now known to be extant.

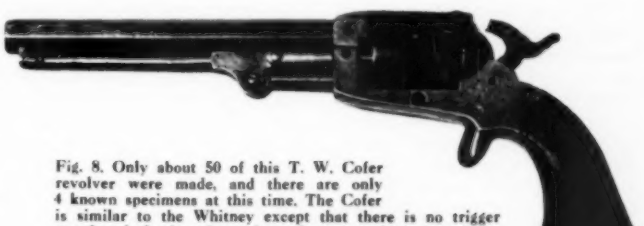


Fig. 8. Only about 50 of this T. W. Cofer revolver were made, and there are only 4 known specimens at this time. The Cofer is similar to the Whitney except that there is no trigger guard and the barrel revolves about a prolongation of the loading lever. Some types required special ammunition.

What happened to Thomas Leech after the firm of Leech & Rigdon dissolved is not known (unless the newly found Leech & Company C.S.A. revolver mentioned earlier is the answer). However, early in 1864 Charles Rigdon became associated in Augusta, Ga., with Jesse A. Ansley, A. J. Smythe, and C. R. Keen, and continued his manufacture of revolvers.

The Rigdon-Ansley

The new firm operated under the name of Rigdon, Ansley & Company, and their product was, of course, the Rigdon-Ansley revolver (Fig. 4). Parts are interchangeable with the Leech & Rigdon, and in appearance they are identical except that the Rigdon-Ansley has twelve cylinder stops instead of the customary six.

These guns are found with serials ranging from low 1500's to middle 2300's which indicates that they started where Leech & Rigdon stopped. The only two known specimens in the 1500 serial are marked on the barrel top "Augusta Ga., C.S.A." All others found are marked simply "C.S.A." on the barrel top. Whether or not all in the 1500 serial are marked with "Augusta Ga." is not known, but at least we do know that all after the middle 1600 serial contain only "C.S.A." Those found with the Augusta stamp can be considered among the very rare Confederate weapons.

Rigdon, Ansley & Company, continued operations until at least February 21, 1865, as their factory is mentioned as of that date by General Gorgas in an order to Col. James H. Burton, directing his supervision over this plant as well as several others.

Like the Griswold & Grier and the Leech & Rigdon, the Rigdon-Ansleys were designed for the cavalry.

The Spiller & Burr

The caliber .36 Spiller & Burr (Fig. 6), brass-framed imitation of the Whitney, comes next on the list.

In early 1861, Edward N. Spiller, a commission merchant of Baltimore, Md., and David J. Burr, owner of a machine company bearing his name in Richmond, Va., sought and secured a contract from the Confederate Government to manufacture 15,000 revolvers. This contract is dated November 30, 1861, and called for delivery of 4,000 revolvers by December 1862, 7,000 by December 1863, and the remaining 4,000 by June 1864. The firm was to receive $30 each for the first 5,000, $27 each for the next 5,000, and $25 apiece for the remaining 5,000.

At first, buildings were leased in Richmond, Va., but none of the revolvers got beyond the paper stage during this period, and in the fall of 1862 they moved the plant to Atlanta, Ga. The first revolver to be manufactured here was not turned out until early 1863.

Despite their contract which called for 15,000, actually only about 1,500 were made, roughly the same number as the Leech & Rigdon, although for some reason they are a great deal less common. The reason for their rarity is not at all apparent unless, unlike the Leech & Rigdon, they were issued to infantry instead of cavalry, and consequently their mortality rate was higher.

Two Groups

Here again, as with most Confederate handguns, this weapon can be divided into two classes or groups. Those whose serial numbers fall under 600 are marked with the firm's name "Spiller & Burr" on the top of the barrel. Those bearing a serial higher than 600 do not contain the firm's name, but are stamped "C.S." on the right or left side of the brass frame.

Variation in marking is due to the fact that the plant was under government contract but operated privately up to serial No. 600. After this number was reached, the factory was taken over by the Confederate Government, although still operated by the same management. Records indicate the factory was purchased by the Confederacy on February 29, 1864, for $125,000.

If the statement is true that all Confederate pistols are rare, then it is equally true that most of the other Confederate handguns fall into the very rare American arms class.

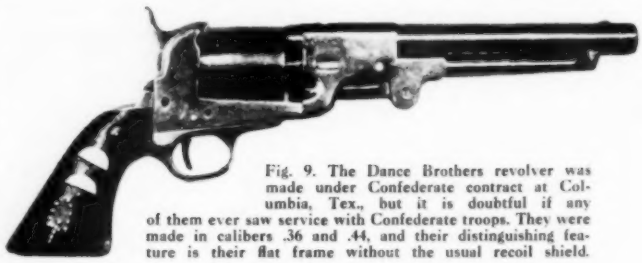


Fig. 9. The Dance Brothers revolver was made under Confederate contract at Columbia, Tex., but it is doubtful if any of them ever saw service with Confederate troops. They were made in calibers .36 and .44, and their distinguishing feature is their flat frame without the usual recoil shield.

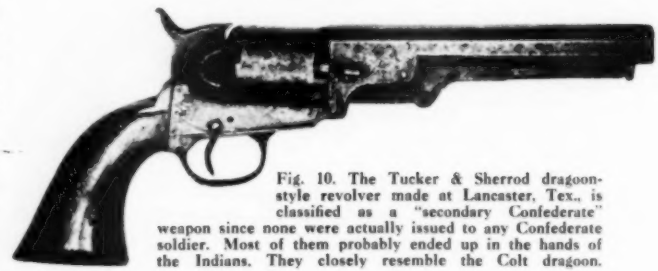


Fig. 10. The Tucker & Sherrod dragoon-style revolver made at Lancaster, Tex., is classified as a "secondary Confederate" weapon since none were actually issued to any Confederate soldier. Most of them probably ended up in the hands of the Indians. They closely resemble the Colt dragoon.

Columbus Firearms

It is not known how many of the Columbus Firearms revolvers (Fig. 7) were made by Louis Haiman and his brother Elias, at Columbus, Ga. but at this writing, there are less than half a dozen to be found in the hands of collectors.

In appearance these guns looked very much like the Leech & Rigdon, having the same caliber, iron frame, and dragoon-type barrel. They are marked on the barrel top with the

firm's name, and also a stamped "C.S." on the trigger guard and, of course, bore serial numbers. According to a letter written by David Wolfson, a former employee of the revolver factory, to Berkley Bowie of Baltimore, all the Columbus Firearms revolvers had round barrels, and it is my opinion that any found with the octagon barrel should be examined very closely before buying.

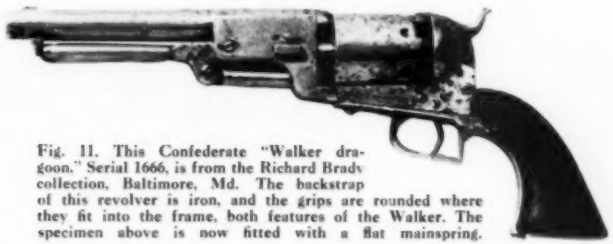


Fig. 11. This Confederate "Walker dragoon," Serial 1666, is from the Richard Brady collection, Baltimore, Md. The backstrap of this revolver is iron, and the grips are rounded where they fit into the frame, both features of the Walker. The specimen above is now fitted with a flat mainspring.

Confederate States patent records reveal that on August 12, 1861, a patent was issued one Thomas W. Cofer of Portsmouth, Va., for a "revolving pistol" (Fig. 8). It is generally believed that about fifty were actually manufactured. If this figure is correct, then forty-six have dropped into oblivion, there being only four known specimens at this time.

In appearance these revolvers are not unlike the Whitney, except that they have no trigger guard and the barrel revolves about a prolongation of the loading lever. A newspaper account of this gun on July 17, 1861, from the Richmond *Daily Examiner,* related, among other things, that the gun required a specially prepared cartridge. Three of the guns found thus far are loaded as any other gun of that time, and for many years historians have puzzled over what was meant by the newspaper account.

Mystery Solved

In August 1950, however, an article by B. D. Munhall appeared in the *American Rifleman,* which solved the mystery. Mr. Munhall discovered a revolver which was lacking the barrel. The cylinder, frame, grips, etc., were intact. On the top of the frame was stamped in two lines: "T. W. Cof——," and "August ——." Part of the stamping was missing (with the barrel), but filling in the missing part, it would read "T. W. Cofer's Patent," and "August 12, 1861."

The most interesting part, however, is the fact that the cylinder for this revolver was made in two pieces, and would have required a specially prepared cartridge!

Obviously, then, this latest find was the early model of the Cofer, later cast off because it was too difficult to manufacture and too hard to secure the specially required ammunition. Consequently the more conventional-type cylinder was adopted.

Dance Brothers Revolvers

Generally classified as Confederate, and actually made under Confederate contract at Columbia, Tex., are the Dance Brothers revolvers (Fig. 9) in calibers .44 and .36. Their distinguishing feature is their flat frame without the usual round recoil shield.

The highest Dance serial number thus far found is 324, and this number probably represents approximately their total output.

It is my opinion that none of these guns ever saw service outside the State of Texas, and it is extremely unlikely that any of them ever saw any service which involved Confederate troops. Sam E. Smith, of Markesan, Wis., well-known authority on American firearms, has been able to trace most of the thirty-five known specimens back to—Texas! Had they seen service in the Confederate Army, certainly some would have been found at Gettysburg, Fredericksburg, Manassas, etc., and not all in Texas.

The Tucker & Sherrod (Fig. 10), dragoon-style revolver made at Lancaster, Tex., can at best be classified as a Secondary Confederate. While it is true that it was made in Texas, a Southern State, and at the time of the Civil War, none were actually issued to any Confederate soldier, and any soldier who did carry one did so through private sale.

Armed the Indians

This firm had a contract with the Confederate Government which was rejected, and none of their guns were accepted. My thought is that practically all of them ended up in the hands of the Indians, which was also the customary fate of the Dance Brothers revolvers.

The fact that they are not a Primary Confederate does not lessen their value to the Colt collector, the dragoon collector, and the Texas collector. They are extremely interesting in their own right. They closely resemble a Colt dragoon, but there is no loading apperture in the barrel frame.

A Confederate which some day will come into its own is the LeMat. Dr. Jean A. F. LeMat, was a Creole physician of New Orleans, who in 1856 patented a 9-shot revolver, the cylinder of which revolved around a shotgun barrel. Almost all early accounts of this gun describe it with the word "formidable," and indeed it was, its owner having nine shots of caliber .42, and, to finish off, a single shot with the caliber .60 shot barrel.

As far as can be discovered, none of the revolvers were manufactured prior to the Civil War, but with that war, inspired by patriotism or hopes of financial gain, or both, the good physician foresook his profession, and turned to the more lucrative calling of gunmaking.

Made in France

Within five months after the start of the war he had a contract with the Confederate Army for 5,000 of his "formidable" revolvers, and shortly afterward landed a navy contract for an additional 2,000. Plans to manufacture in New Orleans by the F. W. C. Cook & Bro. fell through, and LeMat left for France on the TRENT, this being the same vessel that carried Messrs. Mason and Slidell. In Paris, he contracted with the established arms firm of Girard & Son, to make the revolvers for him.

At least 3,000 were made, and almost every one is different in some way from the others. Some had spur trigger guards, some had the loading lever on

the left, some on the right, etc. The lowest serial LeMat is No. 4, in the hands of a private collector, which is marked simply "LeMat's Patent."

LeMat Markings

Less than ten are so marked, for Serial 10 is in the Milwaukee Museum and shows that at that time LeMat secured his commission in the Confederate Army as a colonel, for it is marked "Col. LeMat's Patent." Later LeMats were marked "Syst. LeMat, Bte. s.g.d.g., Paris," or translated, "LeMat's Patent, made for the inventor, Paris."

The contract with the Confederate Army was fulfilled as best as possible, directly from Paris, France. The Confederate Navy contract called for 2,000 to be delivered for inspection in London. The navy guns were imported to England "raw" and were there tested and proved. They were then stamped with British proof marks. The names of both LeMat and Girard appear on the navy LeMats.

Few passed the rigid requirements of the naval inspectors, and consequently the navy LeMats are a great deal more rare than the army model. The revolvers were very popular with Confederate officers, and "The Field Manual for the Use of Confederate Officers on Ordnance Duty," makes mention of them on page 54.

Few dealers seem to be willing to list them strictly as the Confederates they are. It is preposterous to suppose that LeMat, who held a Southern army commission, could have supplied his arms to the North without having his commission taken away from him.

Pinfire Revolver

After the war, LeMat did make a pinfire revolver, on the same principle as his percussion model, and also a breechloader. These are not at all Confederate, but every single percussion LeMat now in the hands of collectors can be classified as Confederate.

Existing records indicate that Caleb Huse, the Confederate arms agent, had exclusive contract with the London Armoury Company, and if this is so, then the London Armoury Company's Kerr's Patent revolvers found in this country can also be classified as Confederate.

Examining Confederate records, a number of names appear which indicate pistol or revolver manufacture, but to date their products, if any, have been unidentified. Some of these names are:

J. P. Sloat of Richmond, Va. (many accounts refer to his "pistol factory"); a George Todd of Austin, Tex., supposed to have made brass-framed revolvers for the Confederacy (this is not the same Todd whose all-brass locks on Alabama muskets were for so long unidentified); Wisecarver, Campbell & Company, of Rusk, Tex.; a Thomas W. Goodwin of Norfolk, Va., maker of a 9-shot revolver; E. J. Ligon of Demopolis, Ala., who patented a breech-loading pistol on September 24, 1861, according to Confederate patent records; Rev. Felix Johnson of Florence, Ala., who made at least one revolver, which was an imitation of a Colt; and Robinson and Lester of Richmond, Va., operators of a pistol factory.

What Has Happened?

What has happened to the guns made by the above, and will any of them ever turn up to be identified? Time alone can answer that question.

In the Battle Abbey Collection, Richmond, Va., finest Confederate collection in existence, there is an imitation Colt dragoon. A peculiarity of this gun is that the cylinder is squared on both ends, the nipples being inset, and cannot be seen from the side. The hammer face is round in order to strike the caps. On the side of the revolver which is crudely made by Colt standards, is stamped "C.S.," and on the top of the part-octagon barrel is roughly stamped "W. H. Henley" (each letter stamped separately). Was Henley the maker or a former owner? I have been unable to find any arms maker by this name.

A private collector in Baltimore has an imitation Colt dragoon (Fig. 11) Serial 1666, which was found on a battlefield near Memphis, Tenn., many years ago. It is believed to be Confederate. Except for the serial, the only other markings consist of a small "w" on the barrel wedge and on the Walker-type trigger guard. On the left side of the backstrap under the grips appears a large "W" and the number "47."

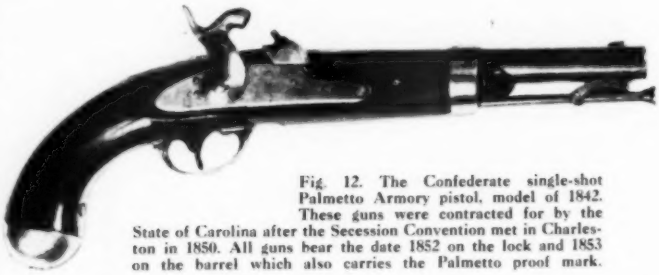


Fig. 12. The Confederate single-shot Palmetto Armory pistol, model of 1842. These guns were contracted for by the State of Carolina after the Secession Convention met in Charleston in 1850. All guns bear the date 1852 on the lock and 1853 on the barrel which also carries the Palmetto proof mark.

Originally this gun took a V-shaped mainspring, which is gone and has been replaced by a screw plug. It now has the flat mainspring, standard for the third model dragoon. The backstrap is iron, and the grips are rounded where they fit into the frame, both features of the Walker. Is this gun merely a Confederate assembly job from some arsenal where parts were utilized to make complete weapons or is it the product of some definite revolver factory?

The Confederate single-shot pistols are not common, but for some reason have never been as sought after as the revolvers.

Palmetto Armory Model

The most common of the Confederate single-shots is the Palmetto Armory model of 1842 (Fig. 12). These guns were contracted for by the State of South Carolina after the Secession Convention met in Charleston in 1850. All the guns bear the date 1852 on the lock, and 1853 on the barrel. The barrels, in addition to the date, contain a palmetto tree proof mark, and the name "William Glaze & Co.," this last being the name of the manufacturer.

Like the Dimick and the Shawk & McLanahan, these guns were made before the war, but here all resem-

blance ends. They were made for the express purpose of defending the State of South Carolina against the North and, being State property, were issued to South Carolina troops at the start of the war. These State troops were later mustered into the Confederate Army.

In connection with the Palmetto pistol is another mystery that has never been cleared up: What happened to the machinery that manufactured this arm? We know that it was purchased by a private firm in Richmond, Va., and was sent to that city in the early part of the war, but as yet no examples bearing Richmond marks have shown up.

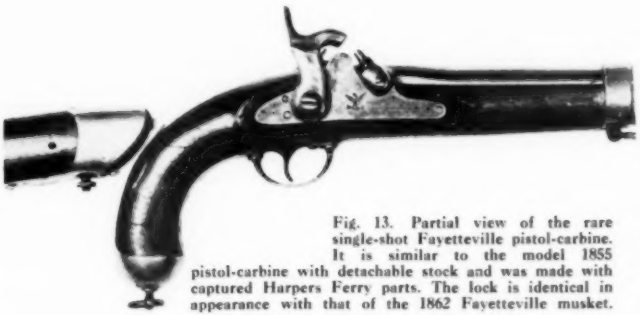


Fig. 13. Partial view of the rare single-shot Fayetteville pistol-carbine. It is similar to the model 1855 pistol-carbine with detachable stock and was made with captured Harpers Ferry parts. The lock is identical in appearance with that of the 1862 Fayetteville musket.

Repaired U.S. Arm

A pistol which is similar and marked on the lock, "C.S. Richmond, Va.," is a part of the Battle Abbey collection. Close examination of this gun, however, leads me to believe that it is a repaired U.S. arm, and indeed a portion of "Middleton," can still be seen on the lock face. This gun's previous history precludes its being a "fake," and, this being so, the chances are that it was picked up on the battlefield and repaired in Richmond, not made there.

The Palmetto pistols are still comparatively plentiful, indicating either that their mortality rate was very low, or that a large number were made.

Could it be that when the pistols of this type were manufactured in Richmond the exact stampings were used on them, and in reality some of the Palmetto pistols were made in Columbia, S.C., and some identically marked in Richmond, Va.? Such reasoning is not logical, but what *did* happen to the Richmond pistols?

A very rare single-shot pistol is the Fayetteville pistol-carbine (Fig. 13), of which only two specimens have been encountered by the writer. These pistols conform exactly with the model 1855 pistol-carbine with detachable shoulder stock and were made from captured Harpers Ferry parts. In appearance, the lock is identical with that of the 1862 highwall Fayetteville musket lock, only it is, of course, considerably smaller.

The U.S. Harpers Ferry Arsenal and Armory was captured by the State of Virginia on April 19, 1861, and all machinery, parts, etc., resulting from this capture were claimed by the State of Virginia and removed to the old Virginia Manufactory at Richmond. The first muskets turned out from these parts are marked simply, "Richmond, Va." After the Manufactory was turned over to the Confederate Government, they were marked "C.S. Richmond, Va."

George W. Munford, Secretary of the Commonwealth of Virginia, under instructions from the Governor, wrote to President Jefferson Davis turning over to the Confederate Government, "all machinery and stores captured by the Virginia forces at Harpers Ferry," and "to allow the Confederate Government . . . the use of the Armory Buildings in Richmond."

Machinery at Richmond

Although this letter is dated July 12, 1861, according to General Gorgas, in his account of the Ordnance Department of the Confederacy, "the machinery of the rifle-musket retained at Richmond, got to work as early as September 1861."

If this be true, then the State of Virginia operated the plant from April 19, 1861, until September 1861, a period of some 4½ months.

Equipment Removed

A goodly portion of the parts and machinery, after being acquired from Virginia by the government, was removed to Fayetteville, N.C. Now if examples of the pistol-carbine with Fayetteville stampings exist, were any made in Richmond, Va., and so marked prior to the machinery being sent on to North Carolina? There is no present answer to this, but the supposition seems logical.

Another Confederate single-shot pistol is the Virginia Manufactory, in both the first and second models. These pistols are exceptionally rare in either original flint or converted. The Virginia Manufactory was located in Richmond, Va., at the south end of Fifth Street on the Kanawah Canal and adjoined the Tredegar Iron Works. It was a State operation which was organized in 1802, and all types of equipment and small arms were made there, including muskets, rifles, swords, fowling pieces, and pistols.

In the early 1820's it closed down, to reopen in 1860 at the threat of war to convert rifles and other weapons for the use of Virginia State troops.

Destroyed by Fire

During the war the Virginia Manufactory lost its identity and was known as the Richmond Armory. It was completely destroyed by fire upon the evacuation of Richmond, April 3, 1865, but remained in operation until that date.

Occasionally Virginia Manufactory pistols are found in altered condition with the name of a private gunsmith stamped upon them; for example, S. B. Cocke, of Richmond, Va. It is believed that these pieces were altered on contract for the State.

Whether the recently revived interest in things Confederate is only a current fad is a matter of some question, but if we have come this far since Richard Steuart's article of 1934 it would be of great interest to see another article on this same subject written seventeen years hence. How many of today's mysteries will then be well-known facts?

Logistical Commands

A Profitable Field for Manpower Economies

Lieut. Col. John W. Schroder

Picatinny Arsenal, Dover, N. J.

The three types outlined here provide much flexibility so as to cover nearly the entire field of necessary requirements for logistical headquarters

THE ever-mounting ratio of supporting forces to actual combat troops points to the rear areas as the most profitable field for making manpower economies through increased efficiency. It is a well-known fact that the development of an organization for the logistical support of armies in the field has lagged behind the development of combat organizations.

Progress Slow

This lag has not been great in the company-sized units, necessary to perform the actual work of providing service to the troops, because the chiefs of the technical services in the past have given a great deal of consideration to the development of such units. It is in the field of larger commands, combining the functions of the various technical and administrative services, that progress has been slow.

No Large Logistic Units

Prior to the Second World War the American Army, by years of study and experimentation, had developed carefully designed combat divisions as well as smaller combat units. Although these divisions have since been modified on the basis of wartime experience and new weapons, they proved efficient and justified their development. On the other hand, the problem of large logistical organizations to support the combat forces had been neglected.

The result of this neglect became apparent as soon as we entered the war. The North African campaign was a masterpiece of improvisation and a glaring example of lack of proper logistical organization and planning. Throughout the war the lack of properly organized and trained logistical command headquarters resulted in the establishment of one improvised headquarters after another and, in many cases, their dissolution shortly after they had become fully trained and capable of operating efficiently.

True in Pacific Theater

This was particularly true in the Pacific Theater, where the nature of the campaign required the establishment of a series of logistical support bases at widely separated points. Each of these bases required a headquarters and troops from all the technical services to furnish the necessary support. In each case, the service troops were drawn from other bases, often as individual companies which had never worked together as a combined force.

Likewise, the headquarters staff was established on a bulk-allotment basis with personnel drawn from many sources, often with little previous staff experience and never with the benefit of having previously worked together as a team. Often the headquarters was not activated long enough in advance of the operations to give it a chance to become fully organized and to do the necessary training.

This situation added to the confusion at critical times and resulted in a lowering of morale and efficiency among staff members and service units.

In late 1944, Maj. Gen. R. L. Maxwell, then G-4 of the War Department, recognized the crying need for improvement and directed the Command and General Staff College at Fort Leavenworth to prepare a study for a logistical command unit. This unit would be organized, trained, and equipped to furnish logistical support to large combat forces, such as an independent corps or army, and it would be prepared to set up or take over and operate a base, a communications-zone section, or even a small communications zone. Thus was planted the seed of the present logistical command.

Study Made

The study was prepared in early 1945 and recommended two units—a logistical division of 45,000 men to support an independent corps, and a logistical corps of 75,000 men to support an army. This study was widely circulated for comments and found general acceptance in principle. There were many specific comments made, the principal ones being that the unit

TYPE	COMMANDED BY	HQ. & HQ. CO. STRENGTH	TROOPS TO BE ASSIGNED	COMBAT FORCES SUPPORTED
A	COLONEL	216	8,000-12,000	30,000 (REINF. DIV.)
B	BRIG. GEN.	419	30,000-50,000	100,000 (REINF. CORPS)
C	MAJ. GEN.	602	70,000-110,000	400,000 (FIELD ARMY)

Fig. 1. The three types of logistical commands.

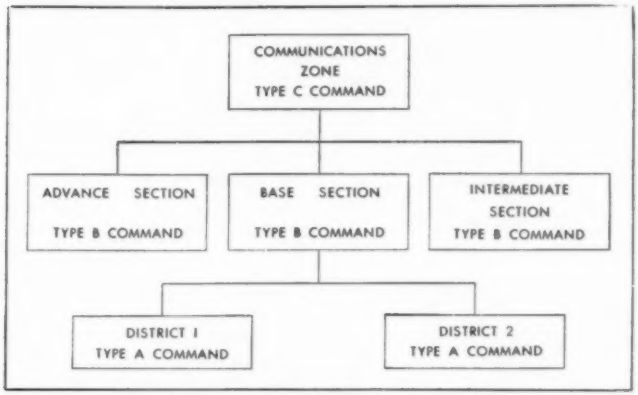


Fig. 2. Typical missions for the three types of logistical commands.

was too large and inflexible and contained units which would not be required in all situations.

Division as Nucleus

The comments were studied, and in October 1945 the Command and General Staff College recommended a single unit to be known as a logistical division and to have a strength of approximately 16,000 men. This basic organic division was to form a trained nucleus to which other units could be added to fit any particular mission to which the division might be assigned.

The "logistical corps" was dropped and the support of larger forces was to be accomplished by expanding the logistical division as necessary. The organic division was regarded as the basic unit of the combined technical services and bore the same relationship to the combined services as the infantry division does to the combined arms.

This unit was then field-tested. Since the war had ended by this time, a 6-month field test was conducted in 1946 by the Continental Base Section in the European Theater of Operations in the course of its normal occupation duties. As might be expected, the course of the new unit was not smooth, but at the end of the trial period the report of the theater was favorable with only minor changes suggested.

In 1948 the logistical division was included in the Organized Reserve Corps troop basis, and the armies in the zone of interior were authorized to activate logistical division headquarters to supervise the training program of various Reserve technical service units. All the armies took advantage of this authorization and the new setup also proved very popular with the Reserves.

Based upon the experience with the Reserve logistical division headquarters, the Department of the Army, in the middle of 1949, directed the Command and General Staff College to prepare new manning tables for the logistical division. Certain changes were directed, and the name of the "Logistical Division" was to be changed to "Logistical Command."

The logistical commands were to be of three types and sizes and were to contain only a headquarters and headquarters company. The types and sizes which were finally adopted are shown in Figure 1. The service troops to be assigned will vary, both as to type and number, within the general range indicated.

The three types of commands provide a great deal of flexibility so as to cover nearly the entire field of requirements for logistical headquarters. In general terms, the capabilities of each of the logistical commands, when assigned the proper service troops, are as follows:

Type I Command

I. *Headquarters, Logistical Command (Type A)*:

a. Furnish logistical support to a combat force of approximately 30,000 men (comparable to a reënforced division) by: (1) Operating a service command for an independent task force; (2) Operating a small communications-zone section (advance, intermediate, or base); (3) Operating a territorial subdivision of a communications-zone section (base, district, or area).

Type II Command

II. *Headquarters, Logistical Command (Type B)*:

a. Furnish logistical support to a combat force of approximately 100,000 men (comparable to a reënforced corps) by: (1) Operating a service command for an independent task force; (2) Operating a communications-zone section (advance, intermediate, or base); (3) Operating a territorial subdivision of a communications-zone section (base, district, or area); (4) Operating an undivided communications zone of appropriate size.

b. Form the nucleus for a small communications-zone headquarters.

c. Exercise command and supervision of two or more logistical commands, Type A.

Type III Command

III. *Headquarters, Logistical Command (Type C)*:

a. Furnish logistical support to a combat force of approximately 400,000 men (comparable to a field army) by: (1) Operating an army service command; (2) Operating a communications-zone section (advance, intermediate, or base); (3) Operating a territorial subdivision of a communications-zone section (base, district, or area); (4) Operating an undivided communications zone of appropriate size.

b. Form the nucleus of a large communications-zone headquarters.

c. Exercise command and supervision of two or more logistical commands, Types A or B.

It should be noted that the capabilities of the different types of logistical commands vary mainly in magnitude and not in nature. The exact nature and magnitude of the mission which can be accomplished can be changed by varying the number and type of service units assigned to the command.

By combining the capabilities of operating and commanding, the logistical commands can be used to build a large integrated communications zone as is shown in Figure 2. In such an organization it would be necessary to

supplement the Logistical Command Type C Headquarters in order for it to carry out its full responsibilities. This is particularly true with reference to personnel needed for the necessary stock control and requisitioning sections in the technical-service staff.

Wrong Assignment

It should be pointed out that the assignment of a logistical command in a field army to command the technical service units of the army is not a proper assignment even though there have been some suggestions made to that effect. The army headquarters contains the necessary staff personnel for the control of assigned technical service units, and any changes which may be needed should be made by reorganization within the army headquarters rather than by adding a headquarters.

It is, however, perfectly proper to attach some of the field army's service troops to the logistical command in the early stages of an amphibious or airborne operation when the logistical command may be acting as an army service command. Such an attachment should last only until such time as the operation has progressd sufficiently to allow the army to assume its normal logistical functions fully.

This discussion has thus far considered only the capabilities of the logistical command overseas. But the command also has its place in the zone of interior both in peace and in war. The logistical command headquarters can serve as a training headquarters for technical service troops and as the operating logistical support headquarters for large-scale manuevers.

They can also be used as area headquarters for logistical support, such as the ASF Service Commands were during the last war. The Type A headquarters is of satisfactory size to operate as a station headquarters when large new camps are activated.

Useful in Disasters

Because of its training in such matters as transportation, supply, construction, sanitation, and medical care, a logistical command is well suited to administer and rehabilitate an area which has been devastated by natural disaster or military action to such a degree that the civilian organization cannot cope with the situation.

The question of providing a troop list for each of the logistical commands is probably the most debated point in the development of the commands. One school of thought calls for a headquarters and headquarters company only, with all necessary service troops to be supplied as the mission requires. This policy has the advantage of allowing the maximum flexibility and eliminating the danger of service units being employed on jobs for which they are not designed.

The other school of thought is to provide an organic group of service troops which would be needed in nearly any possible assignment. This could be done very well with a Type A command since it always has operating troops when used overseas and is not employed as a purely command headquarters.

Esprit de Corps

The advantage of having organic troops is the improved training, discipline, and *esprit de corps* which goes along with the feeling of "belonging." It provides the commanders with the opportunity to learn how the units of all the technical services operate. At the same time, all the services would become accustomed to working together as a unit during the training period.

This method also gives newly assigned units a better base to tie to when it becomes necessary to expand the command, since their counterparts among the organic units can assist them in getting acquainted with the problems and methods of operation in the command.

There are well-established precedents for either type of organization. The "group"-type command unit, which consisted of a headquarters only for a single technical service, was used extensively in the Second World War with excellent results. It gave extreme flexibility and good continuity.

The infantry division is a classic and time-tested example of the assignment of basic organic units. It is customary to attach to it such extra units as may be required for a special operation. The infantry division is probably the poorer of the two parallels since the variety of missions assigned to a combat division is small compared with that of a logistical command.

However, the question of the exact organization of the logistical command, important as it is, is secondary to the basic objective of providing a permanent unified command for technical service troops, based on the principle of keeping the organization flexible.

Five Factors

The exact composition of the complete troop list for a logistical command for any one operation will depend upon several factors, the most important of which are: (1) Mission of the logistical command, including base development mission, if any; (2) Size and mission of the supported force; (3) Capabilities of the service forces available; (4) Area of operations; and (5) Availability and capabilities of civilians and prisoners of war.

The organization of the logistical headquarters is a typical general and special staff organization consisting of the commander's personal staff, chief of staff, deputy chief of staff, general staff sections, and administrative and technical staff sections.

The duties of the staff members are those normally assigned to staff officers, as outlined in FM 101-5. This organization parallels that of the combat headquarters with which the logistical command must deal, and this facilitates operations.

Depending upon the mission of the logistical command, it may be necessary to have additional staff sections to take care of such matters as procurement and civilian relief.

Command organizations, such as group and battalion headquarters, are attached to the logistical command for the direct control of troop operations. The commanders of these units are under the direct command of the logistical commander.

The logistical command has the advantage of providing a large logistical headquarters which can be organized and trained in advance with resultant improved teamwork and morale as the experience gained in one operation is preserved and utilized in later ones.

Thus it is essential to the future efficiency of our logistical support in the field, and, in turn, to our entire defense effort, that this concept of the logistical command be further developed and implemented as rapidly as practicable.

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